

## VOLUET XI.

## GRAPHOPHONE PATENTS.

980,459-1,013,003.
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| Aiken, T.I. | $1,002,479$ |
| :--- | ---: |
| Allwood, J.A. | 984,789 |
| Altenlourgh, W.G. | $1,006,517$ |
| Alyesworth, J.W. | $1,002,482$ |


| Babson \& Haug, | $1,005,765$ |
| :--- | ---: |
| Ballard, H.H. | 985,496 |
| Boswell, R.A. | 997,265 |
| " " " | 999,954 |


| Carter, C.P. | 991,424 |
| :--- | ---: |
| Chaman, W.A. | 998,465 |
| Clement, F.E. | $1,011,32$. |
| Cobb, W.S. | 986,908 |
| Concon, T.T. Tr. | $1,000,582$ |
| Cooper, C.A. | 997,905 |
| Couade, M. | 999,097 |
| Craid, J.R. Tr. | 992,169 |

D. H " H " I.

Dyer \& Jemio,
Fdison, T. A.


Frickson, T.H. Eynon, T.

996, 62.5
1,012,2.50 1,001,004
1,001,746
$1,012,419$
1,011,420
1,013,003
1,001,830
1,011,421

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MAY 151950
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Fischer, A.
989,139
Forrest, R.

Gibson, R.L.
Graft, M.
Graham, M. G.

Ha, Lin’: J, J.H.J.
Harris, J.
Haue ic Babson, Hays, C.O.
Haywood; j). H.
Hess, W. Jr.
Hewitt, A.
Jetter, J.
Johnson, J.A.
Jungren, ${ }_{T}$.

Kitsee, I.
d- Iehnert, H.G.
IUovin, S.
Lewis ic Dyer. Iouvet, J. Iumiere, I..

1,005,025
389,707
1,005,765
999,645
999,646
995,347
981,648
1,004,256
983,061
982,1.38
995, 680

990,144

982,732
$1,003,474$
1,010,355
1,001,418
986,477

| McCauloy, w.w. | 983, 155 |
| :---: | :---: |
| MoLaren, E. | 983,509 |
| Macdonalo, T.H. | 990,366 |
| " " " | $1,003,62.5$ |
| " " | 1,008,605 |
| Massey, T. ${ }^{\text {H. }}$ | 1, 001, 968 |
| Means, J. F. | 981,935 |
| Miller, W.li. | 1,002,074 |
| Mort on, T. | 992,029 |


| Nelson, J.C. \& T. W. | 932,293 |
| :--- | :--- |
| Noll, T. | 993,542 |

Owen, T.W.
$1,011,838$

| Philnot, B.F. | 999,183 |
| :--- | ---: |
| Pierman, A. 1. | 991,361 |
| " " | $1,010,311$ |
| Porter, S.C. | $1,012,910$ |
| Pumnhrey, W.H. | $1,006,123$ |


| Rabbitt, J.A. | 993,293 |
| :--- | ---: |
| Repp, C.B. | $1,003,055$ |
| RumbIe, C.A. | 991,090 |

```
Schmidt, F.W.
&-Smith, M.O.
Soler, T.A.
Spencer &c Thomas,
    (Oriçinai)
Stovenson, G.I.
1,001,171
    399,4i)8
1,001,730
    998,807
(Re-Issue) 13,305-October 31, 1911
    998,807.
    997,870
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| Underhill, g. |  |
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Valiquet, I.P.

930,459
989, 737
$90.5,390$

987,27?


980,713

996,816
985,716
985,717
1,010,333
993, 931
1, 011,238
987,205
1,001,493
990,937
1,007,407

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| :---: | :---: |
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980,470
98\%, 027
982,197
983,416
G. H. UNDERHILL.

PHONOGRAPH,
APPLIOATION FILED FEB. 21, 1906.
980,459.
Patented Jan. 3. 1911.


# UNITED STATES PATENT OFFICE. 

GEORGE H. UNDERHILL, OF BOSTON, IMASSACHUSETTS.

## PHONOGRAPH.

980,459.
Specification of Letters Patent. Patented Jan. 3, 1911.

Application filed February 21, 1906. Serial No. 302,196.

## To all whom it may concern:

Be it known that I, George H. Underimle, a citizen of the United States, residing at Boston, in the county of Suffolk and State 5 of Massachnsetts, have invented an Improvement in Phonographs, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like 10 parts.

My invention relates to sound-reproducing or sound-recording machines. While many features thereof have useful application to other types of such machines, and to those
15 employing but a single record, my invention is particularly applicable and is here illustrated with reference to one type of multiple record machine employing a plurality of cylindrical records adapter automatically and successively to be brought into reproducing or recording relation with reference to suitable reproducing or recording mechat nism, the latter being caused automatically to traverse the face of each record as the
25 same is presenter.
My invention will be best understoon by reference to the following description when taken in comnection with the accompanying illustration of one specific emborliment
30 therenf, which it will be understond represents but a single form, while its scope wil! be more particularly peinted out in the appended claims.

In the drawings,-Figure 1 is a central,
35 vertical seetion, partially broken away, showing the principal operating parts of a phonograph cmbolying one form of my invention; Fig. 2 is a partally broken alway end devation showing the support and travis a side elerationshowing the flexible linked record carmer and its relation to the driving sprockets of the madhine, and Fige. 1 is an end view of the same linked wirnied.

In the drawings, for illastration purpoers. I have shown the varions feabures of my invention emberlied in a maltiple meord phonnograph mploying a surice of wemal cylin ders a, which may be of any nstal on corti-
50 nary "ype. 'The form "phom, herem cmploy in its groneve some to signily " machine of any type for producing or re
producing sounds, it being immaterial whether such machine is of the graphophone or gramophone type or whether it employs 55 cylindrical, disk or other records.

The specific type of machine here shown is provided with a record holder, which may be of any suitable type or construction but which is shown as of the linked or chain type, comprising two chains or sets of jointed links, in the individual links of which are held the several records of the series.

One chain is constructed of a series of 65 similar links $l$, which may be and herein are jointed by means of rods $l^{\prime}$, each of which extends across to a corresponding and oppousite joint in the other chain. The several rods are adapted to engage with the forked arms $m$ of the two sprockets M. M. mounted upon the sprocket shaft $m^{2}$, the latter journaled in the machine frame $A$, so that the linked holder is snstained by the sprockets and carried about as the sprocket shaft is 7 turned.

The link $l$ has an open pocket or depression $l^{2}$ formed on its upper cdge in which one end of the mandrel shaft $n$ is mapten lonsely to rest, the semi-circmlar bottom of the pocket being of appreciably erreater diameter than the diametere of the shaft. I pin $n^{\prime}$ in the overhanging end of the shaf ft prevents lateral withdrawal therent in ome direction.
The other chain member is composed of links of, jointed as are the links /, hmt having in place of the open pockets, apertures $)^{\prime}$. atio of greater diameter than the diameter of the mandrel shal lt. The latter at its cmo nearest to the link o forminates in an emlanged howd $n^{3}$ of greater dimensions than the apertare or there being provided be fwern the shaft and the enfaremed head and abropily taperal portion $\mathrm{a}^{4}$.
lian mandrel when plawe unon the carrier is offednally hede against lomgitmbinal displacement he: the pin $n^{\prime}$ :at me ombland
 howerer, permitting a compration! Pros lateral or siminging nownement of the mamidel
 site cond lownerre the mandrel shaft in nor maily held nginst an inging mownemt ly the
retaining hook $7^{*}$, which is piroted (Fig. 3) upon the link at $7^{5}$ and pressed forward by the light spring $7^{6}$ to overlie the end of the mandrel shaft. The shaft end is therefore 5 readily released when the hook is forced backward. learing the mandrel free to be swung away from the linked carrier for the withdrawal of its record if desired. The shaft end is replaced by merely snapping
10 in the end of the shaft against the inclined end of the hook to force the latter open. For withdrawal, a sharp quick pull on the mandrel shaft will also open the hook.

When the record is in position (see Fig. 1)
15 one end of the mandrel shaft is seated in the step bearing $p$, which is slightly cupped to receive the shaft end and retain it in position. This bearing is shown stationary but, if desired, the same might itself be jour-
20 naled in ball or other frictionless bearings acting thereby to reduce the friction of the machine.

At its opposite end the enlarged end of the mandrel shaft is recessed to receive the
25 winged point $?$ upon the head of the drising shaft $r^{\prime}$, which latter is constantly driven through the sleeve $r^{2}$, in which the driving shaft is mounted for axial sliding movement, although keyed or pinned thereto to rotate
30 therewith. To the sleere is secured the fly wheel $r^{3}$ and driving pulley $r^{4}$, the latter haring a connection by a belt with any suitable source of driving power. The fly wheel tends to keep constant the speed of
35 rotation of the driving shaft by being clutched to and unclutched from successive records, tending therefore to start up the new record instantly at its normal speed. The onter end of the driving sleeve $r^{2}$ has
40 the groored collar $r^{5}$, which is attached to the driving shaft $r^{\prime}$ by a pin working in a slot in the slecre. so that the collar turns with the latter, but may be moved longitudinally to cause the longitudinal clutching
45 or unchutching of the driving shaft. The sprocket and chain-carrier have a position of rest such that a record is then held, as shown in Fig. 1, in approximately its operatire position and in a position to hare its
50 mandrel shaft engaged by the driving shaft. In that position as slown the winged head $r$. of the driving shaft engages the recessed or socketed end of the mandrel shaft. forcing the opposite end of the shaft into the
55 cupped bearing $p$ and lifting the thaft sul)stantially free from contact with the chain carrier. 'The mandrel shaft is then supported at one ead by the bearing $p$ and at the opposite and hy the head of the driving
60 shaft which holids it in suitable and accurate alinement for coïperation with the somud box and stylus, and simultaneonsly imparts thereto the necessary rotary movement.

When the sound box reaches the end of its
travel, by means hereafter referred to, it is 65 elerated and returned to its initial position. Simultaneonsly, the record is released by the driving shaft and restored to the carrier and the sprocket is given a partial revolution, sufficient to bring a fresh record into its ap- 7 proximate operative position, whereupon the fresh record is in turn engaged by the driving shaft and presented to the styhs.

For the purpose of releasing and shifting the records, the sound box or its arm is caused to complete an electric circuit, energizing the controlling magnet S , which is shown (Fig. 1) placed beneath the sprocket shaft in a central location. The energization of the magnet attracts its armature $s$, normally retracted by the spring $s^{\prime}$. This forces the armature rod $s^{2}$ against the upright pivoted lever $s^{3}$, causing the latter to withdraw the horizontal locking bar $s^{4}$ from the locking aperture $m^{3}$ in the face or side of the sprocket M. Simultaneously, the driving shaft $r^{1}$ is withdrawn from clutching engagement with the enlarged socket of the mandrel shaft by pressure of the opposite end of the locking rod against the upright pivoted lever $r^{6}$, which is connected to move the grooved collar $r^{5}$ outwardly and release the record.

The moment the record is released by the clutching head of the driving shaft, the tapered portion $n^{4}$ upon the mandrel shaft engages with the aperture of the link and slides or withdrams the mandrel out of the cupped bearing $p$, so that the shaft when restored to its seat on the carrier is entirely clear of its end support and free to adrance with the carrier or holder.

The record having been restored to the carrier and the sprocket released, the sprocket shaft is free to be turned by mechanism to be described, the clutch shaft in the meantime being held retracted by the latch rod $s^{4}$. the latching end of which remains pressed against the face of the sprocket until the sprocket is turned far enough to bring the next locking aperture in registration therewith, which does not occur until the next record has adranced to the desired position.

The sprocket shaft is turned through engagement of the gear $m^{4}$ and the pinion $m^{5}$, the latter being mounted upon as sleeve with the sprocket $m^{6}$, which is driven through the chain $m^{7}$ and sprocket wheel $m^{8}$ from the counter-shaft sleeve $m^{9}$. The latter is mounted upon the counter-shaft $m^{10}$ and constantly driven through suitable and appropriate gearing $t$ and is adlapted to be clutched to or unclutched from the countersliaft by means of engagement between the movable clutch member $m^{11}$ and a clutch member $m^{12}$. The latter is secured to the sleeve $m^{9}$. while the morable clutch member is secured to a sleeve $m^{13}$ slidably mounted
upon the counter-shaft but keyed thereto and provided with a spring $m^{14}$ which acts to retract the clutch member from engagement. When the magnet S is energized, a
5 depending end of the upright lever $s^{3}$ throws the sleeve $m^{13}$ over against the spring $m^{14}$ and clutches the comnter-shaft sleeve $m^{9}$ to the rotating counter-shaft, thereby causing the turning of the sprockets. The movement
10 of the sprocket shaft continues until the locking rod $s^{4}$ enters the next aperture, whereupon the spring $m^{14}$ disengages the clutch. The same movement of the locking rod frees the upright rod $r^{\prime 6}$ which under
15 influence of the spring $r^{\pi}$ forces the driving shaft into engagement with the mandrel shaft of the fresh record lifting the latter from the chain and alining it in operative position.
The sound box, stylus and attached parts may be of any usual or suitable constrinction and the same are not here shown in detail. The somad box T, however, is secured to the arm $t^{\prime}$, mounted to slide upon the rod $t^{2}$.
25 For its forward movement the arm has a nut $t^{3}$ adapted to engage the finely threaded screw $t^{*}$ when the arm is depressed. The arm, however, is also provided with a second mut $t^{5}$, adapted to engage with the overlying
30 coarse threaded return feed serew $t^{3}$ when the arm is swung slightly upward. The two feed screws are given a constant and suitable rotary movement by gearing (not shown) driven fiom the sleeve $r^{2}$.

During forward movement of the soumb box. the arm is depressed and engages the finely threaded feed screw. When the stylus nears the end of the record an anljustable contact serew $t^{7}$ (Fig. 1) carried by the arm
40 causes a spring comtaci $t^{8}$ to touch the comtact $t^{9}$ and complete an electrical cirenit for chergizing the eontrolling magnet S . Completion of this circuit also energizes a second magnet (not shown), the armatme of which
45 is comerted to the lever 2 (F゙ig. 2), movement of which swings the (ann shalf $n^{\prime}$ "p)ward. The latere moderlies the sommd bex arlo :and canses elevation of the sommel box and stylus and its chgagement with the comar
50 theaded meturt ford serew. A swinging spring-pressed pinn $n^{3}$ (Fig. 1) pivoted at thre ente of the catu shoff smaps into a depmession in fle adjacent machine frame when the shelf is elevated and there mamains it motil
55 the somm hox has retmoned to its initial perition, wherempon a projection $1^{\prime \prime \prime}$ "pom tha sombl tox arm is camed to strike the pen athl widhlian it from the marhime frame, permitting the shelf to drop atul lawer the
60 sembl box and stylts inter mgagernem with tha new recortl, whidy in the mentime lais been adraneed.

Obviously, sarions other wh! of control ling the mevement and artion of the somml
box, as well as the automatic operation of the 65 various parts, may be employed, this specific form of machine being submitted for illustrative purposes only.

Since the mandrel shafts require 110 posi-

 mige to remina the remed mandrels, atid
tive alinement upon the links of the machine, as has heretofore been the case in linked carriers, the individual links may be made of cheap construction and, if desired, stamped out of sheet metal, thereby considerably lessening the cost of a machine of this type.

While I have shown and described a machine embodying one form of my invention, it is to be understood that the latter is not limited to the specific details or form or relative arrangement of parts here shown, but 80 extensive deviations therefrom may be made without departing from the spirit of the invention.

## Claims

1. A phonograph having a linked carrier 85 for loosely holding a record and record-rotating means for engaging a record freeing it from said carrier and alining it in operative position.
2. A phonograph having linked recorel- 90 holding ineans and record rotating means for freeng it from the holding means.
3. A multiple record phonograph having a chain carrier for loosely holding a phorality of records, and record-rotating means 95 for successively cngaging the several records freeing each from the carrice and alining it in operative position.
4. A maltiple record phomograple havinge flexible means for holding a plurality of records, and record-rotating means for successively freeing the records from the holding means and aliming eath in operative por sition.
5. A phonograph having flexible hohlingr 105 means for holding is merod, and werobl-inpporting meats adiapterd to froe the remerd from the lowding means :mal suppord the same in operative relation for the somad pros ducing mechanism.
fi. A phonograph la: vine thexible holdiner

 reverol ame free the same from the hoklinge me:alls.
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12.1
openings being of greater diameter than the diameter of the mandrels and means to free successive record mandrels from the holder.
9. A multiple record phonograph having

5 a flexible record carrier in which the record mandrels are held loosely, means for bringing successive records substantially into operative position, and end engaging means for freeing the records from the carrier and
rotating them without substantial change of 0 position.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GEORGE H. UNDERHILL.

## Witnesses:

Thomas B. Воотн,
Edith E. Chapman.


Fins $1_{-}$


Fig e


INVENTOR.
William W. Young. $_{B Y}$
urbstent $C_{0,}$
ATTORNEYS

# UNITED STATES PATENT OFFICE. 

WILIIAM W. YOUNG, OF SPRINGFIELD, MASSACHUSETTS.

## METHOD OF MAKING TALKING-MACHINE DIAPHRAGMS.

980,4\%0.
Specification of Letters Patent. Patented Jan. 3, 1911. Application filed December 12, 1908. Serial No, 467,225.

To all whom it may concern:
Be it knoirn that I, Widman W. Young, a citizen of the United States of America, residing at Springfield, in the countr of 5 Hampden and State of Massachusetts, have invented a new and useful Method of Making Talking-Machine Diaphragms, of which the following is a specification.

My invention relates to improvements in
10 methods of manufacturing reproducing diaphragms for talking-machines.

Broadly the new method consists in perforating thin shect material, and when deemed necessary in producing burs thereon by punching instead of cutting ont the perforations, and if desired in upsetting such burs.

More specifically the new method may consist in perforating imporous material, in Hing the perforations in the imporous material and in coating the latter with a material or materials, while in a liquid state or plastic condition, which possess the necessary characteristics and qualifications or qualities, in partially drying the imporons material thus treated, and in subjecting the same to pressure. The coating, drying and pressing operations in the order named are usually repeated one or more times and a thorougla and complete drying by subjection to heat is given after pressing.

It will thas be seen that my invention contemplates the progressive method whereby is produced a perforaterl diaphragm of thin material which may or may not have flattened burs thereon and which may or may not have a filling and coating material or materials in its per forations and on one or both of its sides. Or, to state it diflerently, it may be sad that initially at diaphrigun is prodnced which comsists of thim, perforaterd material either with or withom burs thewen and if with bm: then either with or withont them in a flathemed amolifirsu, but by addinge the fillinge and conting and taking the additional stops for that pur-


 terials, the structure of the livat being homer gromedis atme that of the weomel heterio gellemis.

W'ilh the mixa mat the ordinaty sheent metal, wemodneing diaphagms cammonly nsed in talking marhinses, it has not bem possible to whtain the best wesultes from such
machines, because neither of these diaphragms is capattle of producing such results; moreorer, the mica diaphragms or disks, which greatly exceed in number the 60 ordinary sheet-metal diaphragms or disks, are rery fragile and also expensive since there is a great waste incident to procuring disks of the proper size and character; the mica clisks, too, deteriorate with use: the 6 क primary object of my invention, therefore, is to produce a substitute for mica. ordinary sheet-metal, and other kinds of diaphragms heretofore employed, which sulstitute is durable and does not deteriorate, is resilient and resonant. is impervious to moisture and unaffected by climatic changes especially when coated, and is capable of giving out clear, loud, and distinct tones of great depth and rolume, of evenly distribnting the sound waves and making a quick. complete, and perfect recovery, and of lesening to a great extent all alien and discordant noises such as blasts and scratching sonnds which are so prevalent with the ordinary diaphragm.

In the accompanying drawings, which form a part of this application and in which like characters of reference indicate like parts through the sereral riews-Figure 1 is a side view of a sheet metal disk perforated and represents the minfled diaphragin; Fig. 2, a view of a diaphragin ats it appears when the burs left by the perforating punch have been upset or pressed into amall boses and when seen fiom the side upon which such bosies are located, tho appearamed beingr practically the same whether said diaphagem be filled and coated or mot provided that, in the former instance, the eoating be
 in section of the di-k or diapheragon shown in the firs view, and. Fige. I, un marged lagment in wetion of a itiphagem which tas beom lilled and coated and presed.

Ihomgh it is my praction for mater the 100 diaphagmes ont of individnal diaks. tha proces might be appliad to strips or shets w' material which are alterward ('nt in into disks.

Varions kimeds of medals amd theire alloys Whid have been woded ow otherwion mate thin ean be mitimed in the mannfacture of my impored diaphragme. among which mention may la mate of alomimmun wher
 metal for the purpores. In addition to -here metals ofler mutcrials which um sulticicm!
hard and dense and possess the other nece:sary qualities to a greater or less degree may be used, the materials being imporous then ther are to be filled and coated.
In carrying ont my method I take a disk 1 , of aluminum for example. and make a number of small holes 2 therein. The holes $\underline{2}$ are more or less numerous. they extend through the disk 1 from side to side, and they are preferably punched rather than cut so as to leave projections or burs on one side of said disk. as shomn at 3, in Fig. 3. The object of perforating the disk, and more especially of perforating it in the manner
15 just stated. is for the purpose of breaking up the structure of the same and of obtaining the small bosses which are formed by flattening the aforesaid burs, as will presently be made clear. such changes in the character of en beneficial result-, i further olject of the perforations may be to afford means for producing a structure of different materials. or a structure that consists of unlike parts in tex-
25 ture. as is done when the perforations are subsequently filled. This last phase of the invention will be dealt with at length in the course of this de-cription

In some cases the burs 3 may be left in30 tact, but usmally they will be upset to form small, flat bosses 4 . Figs. 2 and 4 , on one side of the disk 1 at the corre-ponding end- of the holes 2 . In reality, the bosses 4 are necessarily somewhat irregular in shape, and
35 the openings in their centers are often so exceedingly minute as scarcely to be discernible, but of course the metal, which has been perforated by punching, when subjected to pressure in the up-etting process tion. In the drawings the holes 2. burs: 3. and boses $t$ are on an exaggerated scale. The di-k 1 is pressed between steel plates or their equivalent to flatten the ours 3 into the

In order to produce a more complex and perhaps in some re-pects better diaphragm than that previou-ly de:cribed. I have recourse to the methoil which I will now explain. and in carrying out which I make use of one or more suitable chemical substanceor materials for a filling and coating agent for the perforated di-k 1. Any material or materials which will give the desired remults and coating, such to woluble mineral- like plaster-of-paris. uxid of zinc. silicate of soda. ete.. but I do not intend to be re-tricted in this particmar: weither do I intend to be limited to the exact equence or momber of -teps in putting aid method into practice. since good re-ult- may $\mathrm{l}_{\mathrm{x}}$ obtained even thongh :ome little departure be made in the order or numbers or both, of such steps.

Assming now, that the disk 1 has been
perforated by punching. and that a filling and coating compound. solution, misture. or emulsion of silicate of soda or silicate of potash and oxid of zinc. for example, has been prepared. the next step is to introduce such filling and coating emulsion into the holes 2 and to spread it on one or both sides of said disk. generally on both sides. The disk. after being treated as above set forth is next dried or rather partially dried, then the filled and coated disk is pressed between the steel plates or equivalent mediums, of which mention already has been made. in order to transform the burs 3 into the bosses $t$ and to compress the filling and coating matcrial or agent within the holes? and on the outside of the disk. Following the pressing the disk is dried br being subjected to heat. One or more additional coats of the emulsion are usually giren the disk, after the foregoing steps have been taken. the application of such coats being followed preferably by the partial drying, the pressing. and the thorough drying by subjection to heat. By subjecting the filled and coated diaphragm to heat at a certain stage or stages during the process of making the same and especially after the final pressing. all moisture is driven out and the compound, misture, solution. or emulsion which constitutes the filling and coating material is rendered hard and otherwise fit to serve its purpose. In the end a diaphragm 5, Fig. 4, is produced which possesses the necessary and desired qualities. In this vien the filler is represented at $f ;$ and the two coats at 7 . By following this method any number of diaphragms may be produced and all will be of a similar nature.

When the burs 3 are flattened the sub- 105 stance of the disk 1 is forced partly into the adjacent ends of the holes or perforations 2 and into the filling when present, but enongh remains outside to form the bosses 4 .

The several partial and complete dryings before and after pressing are effected by exposing the treated material to different degrees of temperature such as will bring about the required result in each case. The last drying after pressing, whether the lat- 115 ter operation be repeated or not. should be rery thorough and complete in order that no moisture whatever shall be left in the finished diaphram. It is generally better to dry after each pressing. provided there be more than one. but in any erent there should be a final drying, as stated abore; it is well to dry after the first pressing also, when there is a subsequent pressing or pressings.
Air drying at an ordinary temperature might do for the partial drying, but would be slow, so I make use either of an open or closed heater of some kind in comection with this step of nly method, and also for
$\qquad$
the complete drying, the open heater being employed as a general thing for both unless the chying is to amount to an actual baking which with these diaphragins is not deemed to be necessary or desirable even.

It has been found that diaphragms made by treating wire-mesl, -cloth, or -gauze iin the manner hereinbefore explained give fairly good results. In this case the per0 forations are in the base medium or disk to start with, and there are no bosses, but otherwise the steps and the resulting product are substantially the same as before.

What I clain as my invention, and desire to secure by Letters Patent, is-

1. The method of manufacturing diaphragms, for talking-machines, consisting in punching holes in thin sheet metal and in so punching thens as to form burs around ting said burs.
2. The method of manufacturing diaphragms, for talking-machines, consisting in punching holes in thin sheet metal and
an so punching them as to produce bur's around such holes at one end of each, and in pressing said burs back into said holes and at the same time flattening them around the latter to form bosses on the adjacent surface
3. The method of manufacturing diaphragms, for talking-machines, consisting
in perforating a piece of imporous material, in introducing filling material into the perforations in said imporous material and coating the latter with such filling material, and in drying and pressing the treated piece of imporous material.
4. The method of manufacturing elliaphragms, for talking-machines. consisting in punching loles in a piece of imporous material and in so punching them as to produce burs around such holes at one and of each, in introducing filling material into said holes and coating sucli perforated material witl such filling material. in drying the treated piece, and in pressing the same to flatten the burs left by the punching operation and to compress the filling material in and on said piece.
\%. The method of manufacturing diaphragms, for talking-machines, consisting in introducing filling material into imporons. perforated material and coating such imporons material with such filling material, in partially drying the treated imporons material, in pressing the same, in subjecting it to heat, and in again coating, partially drying, pressing, and subjecting to lieat.

WM. W. YOUNG.
Witnesses:
F. A. Cutter,
A. C. Fambanis.

$$
\text { Fig. } 1 .
$$



Fig. 3.
Fig. 5.


Nathan Wakefield, ${ }^{\text {Bnountov }}$

## shane

Gasistimbecthan
b.Bradway.

2 b !


# UNITED STATES PATENT OFFICE. 

NATHAN STOWELL WAKEFIELD, OF LOS ANGELES, CALIFORNIA.
DIAPHRAGM FOR SOUND-REPRODUCERS.
980,\%13.
Specification of Letters Patent. Patented Jan. 3, 1911. Application filed January 31, 1910. Serial No. 541,201.

To all whom it may concern:
Be it known that I. Nathan Stowell Wakerield, a citizen of the United States, residing at Los Angeles, in the county of

## 5

 Los Angeles and State of Califormia, have invented a new and useful Diaphragm for Sound-Reproducers, of which the following is a specification.This invention relates to a diaphragm de10 signed especially for phonographs, telephones, or other sound-reproducing instruments, and the principal object of the invention is the provision of an extremely simple and inexpensive diaphragm possessing su15 perior sound-reproducing properties.

Another object of the invention is to provide a diaphragm of the chambered type consisting of a novel arrangement of disks fastened together to form a mitary structure, and so designed as to reproduce the delicate tones or smme shades as well as accorately reproducing the volume and register of the original somnd without the disagrecable, harsh metallic sounds as is the
ase with thaphragms commonly in use.
With these objects in view and others, as will appear as the description proceeds, the invention comprises the various novel feathres of const ruction and arrangement of 30 parts which will be more fully described howemafter and see forth with particularity in the claims appended hereto.

In the aceompansing drawing, which illustrates one embodiment of the invention, Fhare 1s is perspective view of the diaing the imner disk of the diaphagm in seetiom. Fig. 3 is a diametrical section of the diaphragn. Fig. 4 is a plan view showing 40 the immer face of the immer disk. Fig. 5 is an enlaged sectional view of the central portion of the diaphragm.

Similar referene chanachors are emphoyed to designate eomeponding parts thengh45 out the views.

The diaphragm is made of two comparaLively thin disks or plates 1 and 2 of wool on wher suitable material, which are permanently secmed logether, by ghing or other-
50 wise, aceording to the material msed, to comstitute a mitary structure. The disk 1 forms the side of the diapmang that is presented to the chamber of the sommel bex or the somblemendming devien, while the
55 disk 2 is disposed nt the omtside next to the stylus carrying arm. Onc uf the disks, prof
erably the inner disk 1, has its inner face cut out to form a shallow chamber 3. This operation can be performed in a turning lathe, and the cut is made from a point 60 inwardly from the periphery to a point adjacent the center of the disk, whereby a peripheral flange 4 and a central hub 5 will be left. The disk 2 is perfectly flat, both
on its inner and outer snrfaces, and is connected with the disk 1 by being glued to the flange 4 and hub 5. Is shown in Fig. 5 , the hub has a flat face ( for providing a substantial area to which the disk 1 can be fastened. The outer face of the disk 1 is provided with a depression 7 directly at the hub 5 , and the bottom of this depression is provided with an aperture 8 registering with an aperture 9 in the disk 2 for receiving the screw which attaches the diaphragm to the stylns-carrying arm. The hub 5 has a three-fold function, in that it mechanically comnects the two disks together at the center, forms a sound post between the disks, and prevents the screw from being tightened to such an extent as to crack the disks in fastening the diaphragm to the stylus-carrying arm. The clamber disk 1 is provided with : plurality of apertures 10 adjacent to and concentrically arranged aronnd the hub for the purpose of permitting the sommds to be carried from the diaphragm into the machine or somed box by the vibration of the diaphragm. which feature together with the smanding post formed by the lubb, conduce (o) the reproduction of dear. romd tomes. When the diaphragur is made of wood, it is preferable to glue the disks fogether with the ir grains extending transversely 10 each where sin that one disk will serve to strengethen the other. Since the disks ane commed lowedher, beth at the center and edge of the diaphanger : camparatively durable arlicle is proffored. and one having a minimmon thickness rom sidering the box-like form.

Fronn the foregoing deseription, laken in combection with the armompaly ing draw. ing, the athantages of the comstinetion and of the methed of operation will he readily appment to thase skilled in the and to which the invention upperdans, and while I have thempabl the primeiple of operaten of the invention. torethere with the der ice which ! now comside to the the beat imbatiment
 the device shown is merely illostrative, and
that such changes may be made when desired as are within the scope of the claims appended hereto.

Haring thus described the invention, what 5 I claim as new. and desire to secure by Letters Patent, is:-

1. I chambered diaphragm for sound-reproducing devices consisting of a pair of parallel flat-thin disks permanently secured plurality of apertures opening from the chamber.
2. A diaphragm for sound reproducers consisting of a flat disk haring one side hollowed out in the form of a shallow chamber surrounded by a peripheral flange. and a second disk bearing flat against the flange and rigidly secured thereto, one of the disks
having a central hub forming a sounding post against which the other disks bears, the said hub and the disk bearing against the same being adapted to hare a fastening means inserted therethrough for connecting the disks in fixed spaced relation and securing them to a support.
3. I diaphragm for sound reproducers consisting of a pair of flat parallel disks. one of the disks haring a flat anmular flange bearing against the inner face of the other disk and one of the disks having a central hub bearing flat against the opposed face of the other disk. the onter face of the disk having the hub being depressed within the area of the hub to receire a securing device.

In testimony, that I claim the foregoing 40 as my own. I have hereto affixed my signature in the presence of two witnesses.

## NATHAN STOWELL WAKEFIELD.

## Witnesses:

Clatde Miers,
Louie Woodworth.

Patented Jan. 17, 1911.


WITNESSES
G. N. Hello
g. Donsbach.

W. HESS, $J_{\text {B. }}$

TALKING MACHINE HORN,
APPLIOATION FILED JULY 9, 1906.
981,648.
Patented Jan. 17, 1911.
2 SHEETS-SHEET 2.


# UNITED STATES PATENT OFFICE. 

WENDELL HESS, JR., OF TROY, NEW YORK.
TALKING-MACHINE HORN.
Specification of Letters Patent. Patented Jan. 17, 1911. Application filed July 9, 1906. Serial No. 325,297 .

## To all whom it may concern:

Be it known that I. Wexdell Hess. Jr., a citizen of the United States, residing at Troy, county of Rensselaer, and state of New York, have invented certain new and useful Improvements in Talking - Machine Horns, of which the following is a specification.

The invention relates to such improvemen and combination of parts hereinafter described and subsequently claimed.

Reference may be had to the accompanying drawings, and the reference characters marked thereon, which form a part of this specification. Similar characters refer to similar parts in the several figures therein.
Figures 1, 2, 3 and 4, are sectional views illustrating successive steps in the securing together of plies of cloth in the manufacture of my improved phonograph-horn. Fig. 5 is a central, vertical, longitudinal section showing the cloth-body stretched upon a horn-shaped form. Fig. 6 is a plan view of one of the segmental blanks of cloth used in the mamfacture of the horn. Fig. 7 is a view in side elevation of the horn with a portion of the edge broken away and shown in central, longitudinal section.
The principal object of ny invention is to prodnce a sound-strengthening device adapted for use in, or in connection with, musical and somb-reprotucing instriments.
Other oljects of the invention will appear in comnection with the following deseription.

I have shown, and will deseribe, my invention in its preferred application to the horn of a somad-reproducing instrment; but it is also adapted for nse in any case where it is desired to relleet and strenghen somad vibations.
The invention consists in a borly of the desired shape made mo of a phratity of plies of choth stillomed and bound together by a suitable cement or size.

Refering to the drawings wherein the invention is shown in prefered form, I, represents a phomgraph-hom'm modying my invention and made in acoordanee with my improved methord. In making sinel a horn 1 peremaly cout from a wel). or wels. of choth a momber of plies, 2. of substantiall! the

 ment of a phonograph hom of the desired size. I then superpose one прон wnother "
number of said blanks, double that of the number of plies of which the horn is to be made, and secure all of said plies together along one edge, from the tapered to the flared end of the horn, by a line of stitching, 3, after which I apply to the edges so stitched together a binding strip, 4, one edge of which is first secured by a line of stitching, 5 , as shown in Fig. 2, after which the other edge is secured by a line of stitching, 6, as shown in Fig. 3. I have shown in Figs. 1,2 and 3 , eight plies or blanks thus secured together along one edge, it being desired to produce a horn four plies in thickness. After the plies have been thus secured together along one edge, they are opened out between the fourth and fifth plies and four additional plies are applied to each of the four plies so separaterd, and the edges of each eight plies thus formed are secured together in the mamer above described. The unsecured edges of the additional cight plies are then secured together in the same manner completing the inclosure adapted to be made into a horn. The body thus formed is then saturated with starch and is drawn or stretched over a form of the proper size and desired shape and permitted to shrink and dry thereupon. A preferred mamner of saturating the fabric with stareh is to immerse the fabric in a hot liquid solution of cooked -tarch imtil the starch has penetrated to all parts of the falbric and filled the interstices thereol. When the stareh hats become dry and hard, the plies will be firmly bomed together into ar practically solid body which will be hared and still and adapted to retain the shape impatted by the form. The body thas formed iomprise's substantially a honogencoms body of hardened stareh supported hay the plise of fabrice embeded therein. Died the hom hats bem thas formed, its rall cilges ate frimmed :mat rovered with
 piece of tape shat on wemented therempori. At rach of llac fom Iongritudinal se:mis a
 gether exteres of the plies and the binding strip applial thereto, sin that gront strongth is given lo dwe stmeture. 1 ny desimed ere
 it! or timbun of the amble refleded ar trans-

 "rell as he correng the immber of plies of cloth of chich the hom is made.

I have shown and described a preferred construction of horn, but I do not wish to be limited thereto, as the manner of constructing the device can be raried in accord-
5 ance with the use to which the device is to be put and the wishes of the maker or user.

The body of the device may be made up of plies of any desired kind of cloth, knitted or woven, but I prefer to use ordinary woven 10 cotton cloth.

The shape and size of the device can be varied in accordance with the conditions to which it is to be subjected in use.

What I claim as new and desire to secure 15 by Letters Patent is-

1. A sound-strengthening device comprising a substantially homogeneous body of hardened cooked starch, having embedded therein, and saturated therewith, a plurality 20 of plies of cloth.
2. A sound-strengthening horn formed of a plurality of segments each comprising a plurality of plies of cloth sewed together along their neighboring edges, and stiffened and bound together by cement.
3. A sound-strengthening horn formed of a plurality of segments each comprising a plurality of plies of cloth having the neighboring edges of adjacent segments secured together by a stitched seam, and said edges corered by a binding strip, the several plies being stiffened and bound together by cement.

In testimony whereof, I have hereunto set my hand this 5th day of July, 1906.

WENDELI HESS, Jr.
Witnesses:
Geo. A. Mosher, E. M. O'Rellly.

## J. F. MEANS

## ELECTRIC BRAKE FOR GRAPHOPHONES.

981,935.
Patented Jan. 17, 1911.
2 SHEETS-SHEET 1


## J. F. MEANS.

ELEOTRIC BRAKE FOR GRAPHOPHONES.
981,935.


# UNITED STATES PATENT OFFICE. 

JOHN F. MMEANS, OF OIL CITY, PENNSYLVANIA.
ELECTRIC BRAKE FOR GRAPHOPHONES.
981,935.
Specification of Letters Patent. Patented Jan. 1\%, 1911. Application filed April 18, 1910. Serial No. 556,000.

## To all whom it may corcern:

Be it known that I, John F. Means, a citizen of the United States, residing at Oil City, in the county of Venango and State of
5 Pennsylvania, have invented new and useful Improvements in Electric Brakes for Graphophones, of which the following is a specification.
This invention relates to improvements in 10 electric brakes for graphophones.

The prime object of the invention is to provide an improved construction of electric brake mechanism for graphophones whereby the machine will be automatically
15 stopped.
Nnother object is to provide means whereby the circuit closing mechanism of the electric hrake releasing mechanism may be adjusted to operate the brake when the
20 needle has reached any desired place on the record.

With these and other objects in view, the invention consists of certain novel features of construction, combination and arrangement of parts as will be more fully described and particularly pointed out in the appended claim.

In the accompanying drawings: Figure 1 is a plan view of a disk graphoplone with
30 parts broken away and showing the application of the invention; Fig. 2 is a vertical section of the same on the line 2-2 of Fig. 1; Fig. 3 is a rear view; Fig. 4 is a vertical section of a portion of the machine showing larged scale: and, Fig. 5 is a similar view showing an end elevation of the electromagnets for operating the brake releasing devices.

Referring more particularly to the drawings 1 denotes the cabinet in which are arranged the motor and operating mechanism. Above the cabinet and revolibly monnted therein is a turn table 2 on which the record
45 disks are armaged and operated. On one side of the calbinet is secured the hom supporting bracked : in the upper end of which is pivotally momed the somad trmsmitting hor't 4 which carries the reproducer ob has-
50 ing the record engnging needle 6. These parts maty be of the nimul or any desired construction und do not form an purt of the present invention.

My improved brake mechanism comprises
a brake cylinder 7 which is mounted in any 5 suitable position on the cabinet adjacent to the edge of the turn table 2. In the cylinder 7 is slidably mounted a brake piston or plunger 8 carrying on its outer end a brake shoe 9 which is adapted to be forced into engagement with the edge of the turn table for the purpose of stopping the same. The plunger or piston $S$ is projected and held in an operative position by means of a coiled spring 10 arranged around the rod or stem 11 of the piston within the casing 7 as shown. The outer end of the rod or stem 11 extends through and projects beyond the outer end of the cylinder 7 and has formed therein a stop notch 12 with which when the plunger is in a retracted or inoperative position is adapted to be engrged a suitable catch whereby said plunger is held in an inoperative position. The onter end of the rod or stem 11 is preferably turned upwardly to form a handle 13 whereby the plunger may be retracted.

The catch for holding the phunger in a retracted position comprises a cylinder 14 which may be arranged in any snitable position and is here shown as being set into the top of the cabinet. Slidably mounted in the cylinder 14 is a piston or phonger 15 having on its onter end a stop finger 16 which is adapted to mgage the notch 12 in the brake planger rod when the latter is in a retracted position. The phanger or piston 15 is provided with a stem or rod 17 which projects throngh the imer cund of the easing. Aromid the stem on rod 17 within the casing 14 is armanged a moiled projecting spring is the pressure of which is exerted to normally lome the planger ontwardly in the cylinder thas moving the stop linger if to al position for chgaging the wotch ite in the brake phimger rod.
The outer end of the rod or stem 15 of the "utch phunger is opratively commeded by a right :mgnlal arm 1!) with the armatnre en ()

 is here shown an bebig armater in the cabis not 1 mud supportal ly a hrache or hanpor 22 secened to the haner side of the fop of the cabinet. The armature 20 is prefermbly 103 hingedy cemmeded on the bratsed ing is shown at 23. 3.

On the cubinet adjuecont to the onter end
ing end of the stem having a right angular arm thereon provided with an armature, magnets for actuating the same, a sound box, a swinging arm carrying the same, contacts, 5 one of which is carried by said arm, and a source of energy for energizing said magnets when said contacts are closed.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN F. MEANS.
Witnesses:
A. L. Confer,
E. W. Chase.
W. W. YOUNG.

METHOD OF MAKING ACOUSTIC DIAPHRAGMS.
APPLIOATION FILED JAN. 23, 1909.
982,02\%.
Patented Jan. 17, 1911.


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24^{3} \text { Trig. }
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$3 \quad 1 \quad 4 \quad 4 \quad 2 \quad 4$ 4
witnesses: $42^{\prime} 3$ Fine- $7{ }^{-4} \quad 2^{\prime} /{ }^{\prime}$ Inventor. a. COaibanks.
l. It. Stain

# UNITED STATES PATENT OFFICE. 

## WILIIAM W. YOUNG, OF SPRINGFIELD, MASSACHUSETTS.

## METHOD OF MAKING ACOUSTIC DIAPHRAGMS.

Specification of Letters Patent. Patented Jan. 17, 1911. Application filed January 23, 1909. Serial No. 473,819.

## To all whom it may concern:

Be it known that I, William W. Young, a citizen of the United States of Anerica, residing at Springfield, in the county of
5 Hampden and State of Massachusetts, have invented a new and useful Method of Making Acoustic Diaphragms, of which the following is a specification.

My invention relates to improvements in
10 methods of manufacturing acoustic diaphragms for talking-machines, telephones, and the like, and consists in the several steps hereinafter set forth.

The object of my invention is to produce
15 an acoustic diaphragm. of the class indicated above, which possesses in a marked degree not only the essential but the desirable characteristics and qualities of a device of this kind, such as durability and stability,
20 resiliency and resonance, capability of giving out clear, lond and distinct tones of great volume and depth, and of evenly distributing the sound waves and quickly, completely and perfectly recovering its stable cquilib-
25 rium, and immunity from blasts and scratching sounds and other alien and discordant noises.

In the accompanying drawings, which form part of this application, and in which
30 like characters of reference indicate like parts throughont the several views, Figures 1 and 2 are side views of two diaphagms made in accordance with the new method, showing diffrent formations and arrange-
35 ments of the lesser or minor diaphagms, and ligig: : 3, 4, 5, 6 and 7 are sertional views of five diaphragns, on an enlarged or exinggerated seale, illustrating diflewnd mombinafions or arrangements of the dimphagm-
40 forming elcments, incident to the putting intor aflect of said methord.

Before explaining how the new diaphagin is produred. I wish to state that said dialphatgon may lum mate individnally: that is,
 whichover waly is must pmactical with :ans given material on materials. Fion the sak of berevity will apply How following dw
 statent this diaphnagm might le a pmet of a strip or sheme from which it is tolne coll at क力me particmlat stane on at the amb of the

 terial :and which has been performed in wime
suitable manner and apply with a brush or otherwise a compound, solution, mixture or emulsion which possesses the necessary qualifications; next I cover one or both sides of said disk with a thin diaphragmal integument or integuments and apply more of the compound, solution, mixture or emulsion as before; then I partially dry the disk thus prepared, by exposing it to air or subjecting it to lieat; then I subject said disk to pressure between steel plates or the like, and finally I bake the disk. The only important changes in this method, that is to say, important as affecting the structure of the resulting product which is the finished diaphragm, consist-first, in using tiro đlisks, of what may be termed the base material of the diaphragm, instead of one, by placing the scond disk over an integument on the first disk, the perforations in both di:iss being in correspondence and separated by said integument : and, second, in employing two different kinds of integmenents for the lesser diaphragms, the two integuments generally comprising difterent materials and being arranged either both on one side of a di:k of hase matrerial, or one on each side of such disk. In the first of these exceptions there is, as a rule, 110 out side integment or integnments on the completed diaphagm.

A diaphragm proper such as is shown in Fig. 3, wherein 1 mpresents : dink of hase material having perforations: therein, : - 3 reprement integuments on both sides of said disk, and 4 represents a lesser diaphragm atons earch of such perforations, is the resulting produce of the method as tirst outlined. Slightly modition resulting modnct: of the method ass explained appear in the wext there views, in which rige I slows: a
 fonaton disks: 1 will a singlo intox口ment 3 betwern to fintur the lessom diaphasem I: Fig. is shows it diaphagm proper which




 :and two interymments : and is of dillement


 ollow amb that whl me, to all Eltcon and
 sulatantially wlike alme prothered in anlatans.
tially the same way are self-evident facts. In the Fig. 3 diaphragm the integuments? at the time they are applied to the disk 1 should be pressed into the perforations 2 and into contact with each other, so that in the finished diaphragm the portions of sad integuments that are in said perforations and which form the lesser diaphragms $\pm$ will be firmly stuck or cemented together and will therefore be strong and durable. And in the Fig. (i) diaphragm the integument 3 is pressed into the perforations 2 , at the time of manufacture, and caused to adhere to those portions of the integument ob wich cover said perforations, as shown.

Tarious materials for the disk 1 may be employed. among which mention is made of mica, wire-gauze, sheet-metals such as aluminum, steel, etc., and fibrous materials such as more or less heary paper and cardboard or bristol-board. blotting-paper, and the like. The employment of sheet-iron and some other metals renders the diaphragm fit for telephone purposes.

The perforations 2 should be clean-cut holes in the disk 1 , and they may be of various shapes and sizes, arranged in any desired form regularly or irregularly. and more or less numerous. In the first two views there are shown lesser diaphragms 4 Which are outlined by perforations that differ considerably, and from this it is clear that there is almost no limit to the different designs that may be given such perforations both as to outline and arrangement.

The material or combination of materials used for coating the disk or disks 1 and the integument or integuments 3 or 3 and 5 must be of such a nature that the same will adhere firmly to the base material of the diaphragm, that is, the disk or disks, and canse the integument or integuments also to adhere firmly to said base material or to each other, and where integuments are employed 5 on opposite sides of the disk to cause them to stick together in or through the perforations 2; furthermore, the nature of the coating must be such that it will so unite with the other elements and harden during the pros of the shers to produce the stable and otherwise excellent device songht for. I have found that a coating which consists of silicate of sorla, oxid of zinc, plaster of paris and barytes. gires most excellent remults, the silicate of soda comprising about 9.5 per cent. of the emulsion thens produced, and the other ingredients comprising the other is per cent. in proportions of about one-third each. This insion when properly applied to the other elements, pressed and baked, cements such elements together and unites with them. even when the base material or one of the integuments or both is or are metal, to form
hereinbefore enumerated. I do not, however, intend to confine myself to any particular coating material or materials since the range of materials useful for this purpose
is large. In this connection baking japans and rarni-hes may be mentioned as suitable materials for the coatings.

Tissue paper. silk, linen, and various other thin fabrics are exceedingly well fitted for the integument or integuments 3 out of which may be formed or by means of which may be produced the lesser diaphragms 4 . These fabrics take the coating nicely. aclhere firmly to the base material, and furnish lesser diaphragms of the right character. For the integument 5 , which also may enter into the formation of the lesser diaphragms 4, as stated, I prefer to emplor very thin metal such as metal foil, because this takes the coating well, and the results obtained therefrom acoustically are of the best, even when the foil is used alone without the fabric, as it may be.

The partial drying by either exposure to air which is substantially free from moisture or subjecting to direct heat is a step in the method which will be readily understood and needs no further explanation, and the same is true of the pressing or compressing.

The last step, that of baking, appears to be necessary in crder to fix the emulsion or its equivalent, after the latter has been applied to the diaphragmal members and pressed into or against them as the case may be, and thus firmly, completely and permamently to unite the several materials into an integrate structure. With some metal disks and integuments and the a foresaid emulsion, while the latter does not, of course. enter the metal as it does fiber and fabric to a greater or less extent, nevertheless said emulsion apparently forms a chemical combination with the metal when baked, and probably does so.

The perforations 2 are made in the disk 1 when said disk consists of wire-ganze just. the same as when it consists of material which is imperforate originally:

It is not imperative that two integuments, when that number is used, shall meet to be mited in or through the perforations 2, although the structure is stronger when they are so mited and it is thonght that the desirable acoustic properties of the dia- 120 phragm as a whole are enhanced thereby.

Each of the diaphragms proper or major diaphragms shown in the drawings inclucles a plurality of lesser or minor diaphragms, 4, but there might be only one minor diaphragm in each case and that one may be of any suitable size and shape.

In addition to the rariations already noted herein others may be made in my invention provided the scope of the claims be not
125
exceeded. As examples of such additional variations, I desire to call attention to the following, from which it is obvious that the different combinations or arrangements 5 of disks and integuments that may be resorted to are quite numerous. The metalfoil integument 5 may be substituted for the fabric integuments 3 in the Fig. 4 arrangement, or said integument, may be instill into the Fig. 4 arragense white still retaining said integument 3 . In this last example. however. instead of combining only the two integuments 3 and 5 , as in Fig. \%. with the second disk 1 added, I may introduce a second integument 3 so that the integument 5 shall be between the two integuments : and these three between the two perforated disks. Fig. 7 illustrates the lastmentioned arrangement or combination. Foil integuments 5 may be used in the Fig.

3 arrangement, but they need not necessarily meet in or through the disk perforations.

What I claim as my invention, and desire to secure by Letters Patent, is-

The method of making acoustic dia- 25 phragms, of the class described, consisting in applying a suitable moist coating to a perforated base material member and uniting a diaphragmal integument with such base material nember, such integument being thinner than the base material member and extending across the perforation therein to form a lesser diaphragm, in applying such moist coating to the united parts externally, in partially drying. in pressing, and 3.5 in baking.

WILLIAM W. YOUNG.
Witnesses:
F. A. Cutter,
A. C. Fatrbantis.
J. A. JOHNSON.

STOP FOR GRAMOPEONES.
APPLIOATION FILED APR. 21, 1910.
982,138.

Patented Jan. 17, 1911.

rig. 1


ฮ̇mentor

2Nitucsses
rig. 3

23y


# UNITED STATES PATEN' OFFICE. 

# JOHN A. JOHNSON, OF SAUK CENTER, MINNESOTA. <br> STOP FOR GRAMOPHONES. 

982,138.
Specification of Letters Patent. Patented Jan. 1\%, 1911.
Application filed April 21, 1910. Serial No. 556,843.

To all whom it may concern:
Be it known that I, Jomn A. Jominson, a citizen of the United States, residing at
Sauk Center, in the county of Stearns and
5 State of Minnesota, have invented certain new and useful Improvements in Stops for Gramophones, of which the following is a specification.

This invention relates to gramophones and 10 particularly to brakes for the sane which will stop the rotation of the turn table when the extremity of the record has been reached.

It also contemplates the construction of a device of this type which may be retained
15 from operation while the same is being set.
A further object is the provision of a means whereby the records may be gaged and the brake set to conform with the size of the record.
20 With the above and other objects in view this invention consists in the construction, combination, and ararngement of parts all as hereinafter more fully described, claimed, and illustrated in the accompanying drawings, wherein

Figure 1 is a top plan view of a gramophone embodying the present invention, illustrating the box and turn table diagrammatically; Fig. 2 is a central longitudinal
30 section of the brake operating mechanism; Fig. 3 is an interior elevation of one of the operating slaft cngaging levers; lig. 4 is an end elevation of the brake operating shaft illnstrating the coinperation thereof with the gramophone shaft.

The present invention resides in the provision of a worm gear carried on the exntral vertical shaft of a gramophone diredy beneath the turn-table, satd worm gementi-
40 ing with a worm keyed to as shatt, amb said shaft extending ontwardly toward the periphery of the turn-table and is theaded substantially its entire long(l). A fubman member is momind mider the turn table amd
 positely dispored spring prosised lowers which are themaded to engage the therads wi said
 member is drawn inwardly mod doe th the
50 fuct that the same carries al bonke which will opernto against the celge of the fown table, consegnently the rotution of and timo talde will cense.

An immer tubnhar member porvided with an entugement ot its imber crovemity is w ciprocatingly momited within the miter
tubular member and is so constructed that an enlargement at the terminal thereof will release the levers aforesaid from engagement with the threads on the shaft perinitting the 60 brake carried by the outer tubular member to be withdrawn from the periphery of the turn table.

Reference being had more particularly to the dramings 10 indicates the top of a gramophone box provided with a central vertical shaft 11 on which is rigidly momnted the turn table 12. Keyed to the shaft 11 directly below the tum table is a worm gear 13, said gear being adapied to rotate with the shaft and at the same rate of speed. A shaft 14 is journaled in the bearings 15 adjacent to the worm gear 13 and is provided with the threads 16 extending substantially from one of said bearings to the terminal of the shaft. In order that this shaft may be constantly rotated by the worm gear 13 , a worm 17 is keyed to the shaft it between the brackets 15 and is constantly in mesh with the gear 13.

A guide or bracket 18 is secured to the top 10 of the gramophome box adjacent to the periphery of the furn table 12, in which is slidably momed the outer tubmar member 19 which incases the threaded extremity of the shaft 14. The imer terminal of this tubutar nember is provided with the oppositely disposed cars 20 to which are pirot"d the levers 21 , the rear terminals of said levers having the springs bearing thereagainst to insure the constant engagement of the thead 16 by the forwated the eaded tominals of the levers 21 , salid springs being carried by the dibntar member. The unter side of the member 19 is provided with a gage 2:3 which in combination with the branked pordenes a means wheredy the brake maty be adjusted for valume sizes of records.

A bake memberel is amper by the tuhnlat member 1! in shel a mamer that the salle is adapted to bear arainat the periphery of the tarn tahle of the fulmar member is dh:a wo in ly the comtact of the dhemeded Fener: 21 with the contamt! rotating slaitill.

A11 inmer tubulne member 25 is slidably menntery in the member !! and is pron idad
 lavement 2li, the - hot- of which am adaphed
 (1) diseming en the shaft 1.1 when the inmere
member 25 is forced inwardly, thus permitting the brake to be withdrawn from the edge of the turn table.

The outer terminals of the tubes 19 and 25 are provided with the finger pieces 27 , which facilitate the operation of the device. From the foregoing it will readily be seen that when the threaded levers 26 are brought into contact with the threads 16 of the shaft
10 14, which is constantly in rotation, the tubutal member 19 will be gradually drawn toward the center of the phonograph, as a result of which the brake 24 will be brought into operative engagement with the periph-
15 ery of the turn table 12 , thereby stopping the rotation thereof. When it is desired to release the brake and withdraw the tubula member 19 in order that the next record may be started the imer tubular member 25 is
20 forced inwardly, the slotted enlargement 26 causing the lever's 21 to disengage the shaft, thereby permitting the tubular member 19 to be withdrawn.

Having thus fully described my invention. 25 what I chaim as new and desire to secure by United States Letters Patent is:

1. An automatic brake for talking machines, comprising in combination with a turn table, of a threaded shaft adapted to
30 constantly rotate with said turn table, and means operative by the threads on said shaft whereby a brake may be applied to said turin table.
2. An automatic brake for gramophones, comprising in combination with a turn table, of a rotatable threaded shaft adapted to constantly rotate with said turn table, means operated by said shaft for applying a brake to the periphery of said turn table, and
40 means whereby said last named means may be adjusted.
3. An antomatic brake for gramophones comprising in combination with a turn table, of a rotatable threaded shaft adapted to constantly rotate with said turn table, means operated by said shaft for applying a brake to the periphery of said turn table, and means whereby the brake may be released.
4. An automatic brake for gramophones 50 comprising in combination with a turn table. of a threaded shaft adapted to rotate therewith, a tubular member mounted under said turn table and adapted to incase said shaft, means whereby said tubular member
55 may be drawn inwardly by said shaft, and a brake carried by said tubular member.
5. An automatic brake for gramophones comprising in combination with a turn table, of a threaded shaft adapted to rotate
therewith, a tubular member mounted under 60 salid turn table and adapted to incase said shaft, means whereby said tubular member may be drawn inwardly by said shaft, and means whereby the brake may be withdrawn from the turn table.
6. An automatic brake for gramophones, comprising in combination with a turn table operating on the central shaft of a gramophone. of a threaded shaft disposed below said turn table and driven directly from said central rertical shaft, a tubular member reciprocatingly mounted on said shaft, means carried by said tubular member whereby the same may traverse on said shaft, and a brake carried by said tubular member adapted to operate against the periphery of the turn table.
7. The combination with a gramophone having a central vertical shaft and a turn table carried thereby, of a threaded shaft mounted on said gramophone beneath said turn table adapted to be operated directly from said central vertical shaft, a tubular member reciprocatingly mounted on said shaft, levers piroted to the inner terminal of said tubular member adapted to engage the threads of said shaft, and means whereby said levers may be disengaged from said shaft.
8. The combination with a gramophone having a central vertical shaft and a turn table carried thereby, of a threaded shaft mounted on said gramophone beneath said turn table adapted to be operated directly from said central vertical shaft, a tubular member reciprocatingly mounted on said shaft. levers pivoted to the inner terminal of said tubular member adapted to engage the threads of said shaft, and a secondary tubular member reciprocatingly mounted in said first mentioned tubular member adapted to disengage said levers from said threaded shaft.
9. The combination with a gramophone, of a shaft adapted to coöperate with the turn table thereof, means adapted to be drawn inwardly by said shaft, a brake carried by said means adapted to coöperate with the periphery of said turn table, and spring actuated shaft engaging members carried by said brake carrying means.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN A. JOHNSON.
Witnesses:
Alex Benson, G. L. Cooper.
W. W. YOUNG.

TALKING MACHINE DIAPHRAGM.
APPLIOATION FILED MAY $4,1909$.
982,197.
Patented Jan. 17. 1911.


Fig. 1 .


> WITNESSES:
> a.e. Painbanko
> ST. S. Buttur

INVENTOR.
$\underset{B Y}{\text { Wieliam W. Young. }}$

- Usbstertco.

ATTORNEYS.

# UNITED SIATES PATENT OFFICE. 

WILLIAM W. YOUNG, OF SPRINGFIELD, MASSACHUSETTS.

## TALKING-MACTINE DIAPHRAGIM.

982,19\%.
Specification of Letters Patent. Patented Jan. 1\%, 1911.
Original application filed December 1, 1908, Serial No. 465,474. Divided and this application filed May 4, 1909. Serial No. 493,840

## To all whom it may concern:

Be it known that I, Widitiar IV. Young, a citizen of the United States of America, residing at Springfield. in the county of
5 Hampden and State of Massachusetts, have invented a new and useful Talking-Machine Diaphragm, of which the following is a specification, the same being a divisional part of an application filed by me in the of December, 1908, Serial No. 46 ,.474.

My invention relates to improvements in reproclucing diaphragms for talking-machines, and consists of a more or less porous material impregnated and permeated and surface treated with a filling material or materials of suitable character. hardened. and provided with a raised portion or integral protuberance if desired, all as hercin-
20 after set forth. This diaphragm is exceedingly compact. hard. and tough, although thin, has smooth and even surfaces, and possesses a uniform thickness throughont excepting in the center where may be locaterl
25 the above-mentioned protuberance.
As is well-known, it is not possible to obtain the best desults. with deprocheneng diaphatems made of miea or sheret-metal, these especially the former being the kind com-
30 monly nsed in talking-machines, and besides the miea disks or diaphragms are extremely fragile and also expensive because of the waste incident to procming disks of the proper size, and the primary olject of my
35 invention is to produce a substitnte for mica. sheet-metal. and other varieties of diaphragms, which substitute possesses the necessary or desirable features ontlined in the preereding pararapha, and in addition is re-
40 silient and manant, is impervions to moisture and mafferted hy chmatio changere, and is capable of griving omb clear, lomed, and distinct fomes of great deph and volume, of evenly distribnting the somed waves and
 inge its stable equilibrimm, and of lessenting to a eqreat extent, if mot madicating altorether.
 and seratchingesmuds which are su fremment
50 with the ordinary diaphagan. I allam this ohjeet by the meatis illnstrated in the ancompanying drawings, in which-
liugure 1 is a side vien of a diaphagm which cmbordies my ins (mintor, mul, Vigr. ", "1
cross-section, on a large scale, of said dia- 55 phragm.

Similar figures refer to similar parts in the two viems.

As a base material for my diaphragm, I find that a disk 1 of pure, hard-finished bristol-board which is quite thin answers better than anything else so far triecl, especially if the same be perforated before it is filled, although ahmost any fibrous material or fabric, which is sufficiently porous to take up an adequate amount of filling material or materials, may be employed, such as leather, paper, or cloth, for example.

The perforations or holes in the disk 1 are represented at 2. These should be very fine, quite frequent, and extend through said disk from side to side. The perforations or holes 2 are for a two-fold purpose: first, to open numerous ways into the interior of the disk 1 so as to elable the filling to penetrate and permeate all parts of the disk structure and to become thoroughly and evenly distributed therein and therelhrough, thus insuring that the diaphragm shall have practicaly no unfilled portions; and, second, to aftord means for prochucing a diaphagm having a structure of dilferent materials, or a structure that is hroken mpor divided into mulike parts as to texture.
The filling for the lextme of the disk 1,8 Whether or not said disk be perforated, preferably consix:s of one or more minerals held in solution in water by an alkali, together with an inert or nentral mineral that will mix with water and form with the other solution when combinet therewith a sutable compenmal. mixture, or cmulsion. Silicate "f somba of silicate "f potash and oxid uf天ine are what I prefre to now, simee the sollution on compumal sembling from the comblimation in the manmer just stated of such inEralionts reatily and Horonghly mites "ith the di-h ! hy ratering the lexture of the same and impate for shed disk the reguired popertics. The disk 1 is filleed with the a foresatid solution or compermed, is coated
 "ith the tilling solnt fin or compormo. and is

 portion in the emter themof maty he left in


58595
100
there is a protuberance 3 on one or both sides. This protuberance may be produced by having openings in the centers of the devices used in compressing the disk, and thus free while the remainder of the clisk is being compressed; or the protuberance may be produced by providing compression devices with male and female parts, but in this last event the raised portion of the disk would be of the same density as the other parts and would not be any thicker as it is in the other case.

The qualities of the diaphragm are not affected by the position of the protuberance 3 , that is, whether it be on one side or the other of salid diaphragm or whether it be upon both sides, therefore said position in this respect is immaterial. The protuberance 3 not only reinforces the diaphragm by assisting in keeping the diaphragm from getting out of shape or warping and at the same time by increasing the strength, durability, and endurance of the same, but enhances the sound reproducing qualities of the diaplneagm in a most marked degree, and is especially efficacious in ealusing the sound waves to be evenly distributed and the diaphragm to make a quick and perfect recorery thereafter. 'This protuberance is not built up ont of other materials or parts, but is an integral part of the diaphragm itself, therefore it camot work loose and so produce a rattling sound or blast as it otherwise would be liable to do. As already noted, the protuberance may be omitted.

The compressing and heating to which the disk, filled and coated with the deposit from the mineral solution or compound, is sub-
jected, sets the ingredients and renders the 40 finished diaphragm hard and fit for use.

The diaphragm made of the materials and in the manner herembefore described possesses certain characteristics that approach those of metal or glass, such as hardness, re- 45 siliency, resonance, and smoothness, and is in all respects suitable for the purpose for which it is intended.

What I claim as my invention, and desire to secure by Letters Patent, is-

1. Is a new article of mamufacture, a diaphragm, for talking-machines, having a less dense center than the surrounding portions.
2. As a new article of mamufacture, a diaphragm, for talking-machines, having a 55 raised central portion which is less clense than the surrounding part.
3. Is a new article of manufacture, a diaphragm, for talking-machines, consisting of a one-piece filled and hardened disk having a center of less compactness than the surrounding portions of said disk.
4. As a new article of manufacture, a diaphragm, for talking-machines, consisting of porous material and a non-rolatile deposit 65 from a silicate. alkali, and neutral mineral solution.
5. Is a new article of manufacture, a diaphragm, for talking-machines, consisting of a one-piece disk of porous material which 70 has perforations therein ontside of the center and has been filled and coated with a non-volatile deposit from a silicate, alkali, and nentral mineral mixture.

WTLLIAM W. YOUNG.
Witnesses:
F. i. Cutter,
d. (. F.hmbinks.
D. C. \& J. W. NELSON. AOTOMATIC STOP FOR TALKING MACHINES.

Patented Jan. 24, 1911.


IFicg. 2.


Inventors
Delpros Cidelsom,
จVituesses
Sames W.Nelson,
GHtoward Wahnsly,
colunuerhed.


# UNITED STATES PATENT OFFICE. 

## DELPHOS C. NELSON AND JAMES W. NELSON, OF IMARION, OHIO.

## AUTOMATIC STOP•FOR TALKING-MACHINES.

982,293.
Specification of Letters Patent. Patented Jan. 24, 1911.
Application filed April 23, 1908. Serial No. 428,723.

## I'o all whom it may concern:

Be it known that we, Delpios C. Nelson and Jines IV. Nelsor, citizens of the United States, residing at Marion, in the county of
5 Marion and State of Ohio, have invented certain new and useful Improrements in Automatic Stops for Talking-Machincs, of which the following is a specification, reference being had therein to the accompany-
10 ing dratings.
This invention relates to automatic stops for talking machines, and the object of the invention is to provide means for antomatically stopping the movement of a record
15 support when the sound-reproducing device has reached the end of the record: and to provide adjustable means for controlling the actuating mechanism for the stop.

With these objects in view our invention
20 consists in certain novel features of construction and in certain parts and combinations hercinafter to be described, and then more particularly pointed out in the chams.

In the accompanying drawinge, Figure 1
25 is a side clevation of a talking machine equipped with our invention; and Fig. 2 is a top plan view of the same. with the sound-reproducing derice and its support removed.
30 In these drawings we have illustrated the peferred form of our invention and have slown the same as applied to a well known form of mathine cmbodying a disk reeored, lom ohviom-ly, the devier is capable of wide
35 variations from the paticular eonstruction hurein show and can be aldapted to dillerent tepes of mathines. Wre have bere show the talking mathine as comprising a motor casing I having momed therem the m:mal
40 turn-table ? Whels supports the disk reeored 3. An arm 4 is pivotally supportad at its onterem on a backed.5 (antiod by the motor casing 1 and extemble invardly nior the redord 3 and carrics at the inmer (and therent a
45 smitable somed repmeducing deatere af pro-

 as of ordinary colsimation, is peosidal for

60 mad the record disk, which is stppertent theresin.

As is well known in talking machines of this type, the needle 7 of the sound-rcprorlucing device travels over the reccrd from a point near the periphery thereof to the end of the record which lies near the center of the disk. When the disk continues to rotate after the pin has reached the end of the record groove, it defaces and damages the record, as well as causes an umpleasant sound. In order to overcome these objcctions, we have devised means for automatically actuating the stop) or brake 8 to (heck the movement of the turn-table and the record carried thereby as soon as the soundreproducing device reaches the end of the record and have provided means controlled by the movement of this sound-reproducing device over the record for controlling the automat ic stop-actuating mechanism. In the present instance, whe have shown the stopactuating mechanisin as comprising a morable member. such as a bar !? Which is preferably mounted $11 p$ on a basc 10 sicured to and extending rearwardly from the cdge of the motor casing 1. This bar 9 is operatively connected to the brake 8 and is adapted to be moverd in such a direction as to operate that brake. In the prefered comstruction, the bar ? is comnected to the base 10 loy means of suitable links 11 which are pirotally connected at one end to the bare! and at the othere end (1) a plate 12 , which is rigidly seepored to the hase 10 near the imwer edge thereof. In arm 1:3 is pivotally commered at ome end to the bar !a and is comected near it other and In a sop controlling momber or actuating lever 1.t, which is operatively commeded to the stop wr brake s. The stop-rontrolline go member mas be of any sutahle character and may be operatively commetal to the - (n) either for the pimpore of anthating the same or for controlling a epring actuated s(op). Tha combolling member or lewe is


 and serom throded and evtombimis thomeh

 by meabs of jantmita 18 mombed on the
screw-threaded end of the rod 15 on opposite sides of the apertured lug 16. The arm 13 is preferably made adjustable by forming the same in two parts and slidably con5 necting said parts one to the other, the relative morement of the two parts being controlled by the thmmb-nut 1 s .

The present form of comnection between the bar 9 and the base causes said bar to move diagonally of the base 10 and in a direction away from the brake and toward the end of the record, which, in the present instance, is the center of the record disk, the bar being actuated by a spring 19 which is
${ }_{3} 5$ mounted upon the base 10 and engages the rear side of the bar 9 , thus tending to force the same inwardly torrard the record. When the bar 9 reaches a certain point in its diagonal morement, the inner end of the arm
2013 is mored beneath the edge of the turntable and into the path of a projection, such as a pin $13^{\text {a }}$, depending from the under side of the turn-table. The pin $13^{a}$ coming in contact with the arm 13 moves the same
25 about its pirotal center and causes the connecting rod 15 to actuate the lever 14 of the brake 8 to check the movement of the turntable. The inward movement of the bar 9 is controlled by suitable means connected
30 with the sound-reproducing device 6 , and, in the present instance, this means comprises a finger 20 supported from the arm 4 which carries the sound-reproducing device and is mounted thereon by means of a sleeve 21.
35 The lower end of the finger 20 extends in the path of the bar 9 and serves to control the inward movement thereof. As the sound-reproducing device 6 moves over the record, the arm 4 moves about its pirotal
40 center and the finger 20 is carried with the same and is moved diagonally of the base 10 along a line which intersects the line of movement of the bar 9. Consequently, as the sound-reproducing device approaches 55 the end of the record, the finger 20 will have been moved inwardly a distance such as to cause the further movement of the bar 9 to more the arm 13 into the path of the stop $13^{a}$. Thus the arm $13^{a}$ will be positively
50 mored about its pirotal center and will actuate the stop-controlling member it and the stop $S$ will be caused to engage the edge of the turn-table. In order to instantly actuate this brake we prefer to provide the bar
559 with an offset which is so located on the bar that the finger 20 will reach the same and pass off the shoulder formed thereby immediately after the sound-reproducing device reaches the end of the record. This
60 offset is preferably formed in the bar 9 by forming the same in two parts, the main portion of the bar being provided with a reduced extension 22 upon which is mounted the outer end 23 of the bar which is pro-
vided with a tlumb-nut 24 for holding the 65 same in its adjusted position thereon. The width of the portion 23 of the bar 9 , which portion is that engaged by the finger 20 , is greater than the width of the extension 22 to the bar 9. Consequently, a shoulder 2.5 is formed. this shoulder being of a depth such that when the finger 20 passes berond the same, the bar 9 will be moved quickly forward and the arm 13 brought into the path of the pin on the turn-table, and the engagement of the pin with the arm will actuate the brake and instantly stop the morement of the record. By making the outer portion 23 of the bar 9 adjnstable, the location of the shoulder 25 can be adjusted to accommodate the same to records of different size, thus enabling the machine to be stopped at the end of the record, regardless of the size of that record. However, in order to insure that the finger 20 mill pass beyond the shoulder 25 immediately upon the sound-reproducing device reaching the end of the record, we prefer to form in the record a groove 26 which forms an extension of the record groove and turns sharply toward the center of the disk, as shomn, thus carrying the needle inwardly, and, consequently. moving the finger 20 quickly through a considerable distance. Which distance is sufficient to insure that said finger will pass berond the shoulder 25 and thus permit the bar 9 to more inwardly a distance sufficient to actuate the brake S. Means are also provided for retaining the bar 9 in its open position against the tension of the spring 19 when it is so desired, and this means preferably consists of a spring-clip 27 secured to the base 10 and adapted to engage the bar 9 and hold the same against movement when it is desired to render the derice inoperative. When it is clesired to place the device in operation the bar 9 is moved forward until the formard edge thereof extends beyond the clip 27 and the bar 9 is again under the control of the 110 spring 19 and the finger 20 .

The operation of the derice will be obrious from the foregoing description and it will be apparent that we have prorided antomatic means for controlling the brake or stop mechanism which controls the movement of the record-supporting means; that this means is controlled by a part connected with the sound-reproducing device and is so actjustable that the movement of the record will be stopped immediately after the sound-reproducing derice has reached the end thereof, thus aroiding the defacing of the record and also doing away with the unpleasant sounds cansed thereby. It will also be apparent that the stop-controlling member is positively actuated by the pin on the turntable coming into contact with the arm
which is connected with said stop-controlling member. thereby rendering the operation of the device certain.

We wish it to lee understood that we do 5 not denire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus fully described our inven-
10 tion. what we claim as new and desire to secure by Letters Patent, is:-

1. In a talking machine, the combination, with a movable record, a sound-reproducing device adapted to move over said record, a
I5 stop for controlling the movement of said record, and a stop-controlling menber, of a spring-pressed member for actuating said stop-controlling member, and a part connected to and adapted to move with said
20 sound-reproducing device and lying normally in the path of said spring - pressed member for controlling the movement there of.
2. In a talking machine, the combination,

25 with a movable record, an arm movably supported above said record, a sound-reproducing device carried by said arm and adapted to move over said record, a stop for controlling the morement of said record, and a
30 stop-cont rolling member, of a movable bar operatively comected to said stop-controlling momber. a spring tending to move saicl har in one direction, and a finger carried by said arm and notmally extending into the
35 path of said bar to control it- movement.
?3. In a talking machine, the combination, wifl a movable reeord, an arm movably supfonterl above said mecord, a somed-reproducing device carried by said arm and adapted
40 to move over satid record, a stop for control. ling the moremont of said record and a stop controlling member, of a base a bar, links for connceting said har in said base, a spring for adtatiog sad bar, means for opera-
45 tively (ommerting sabl bar to said stop confrolling members, and a part combed with said amb for controlling the movement of said bar.
4. In a talking machine, the combination,

50 with a movable record, an arm movably sunported abome said record, a soumd-reproducfog devire carried by sidid arm and ardapted (0) mowe over said recod, a stop for controlling the movement of said record and a stop-
55 coutrolling member, of a base, a bar, links combecting satid hase to said bate a spring for actating said har, an armporotally cont


60 bere, and a pant enmertod with the firstmentioned amer for controlting the mose momit of sald bate.
5. In a talking machine, the combimation, witl at movable recond, :an arm mosably
supported above said record, a sound-repro- 65 ducing device carried by said arm and adapted to move over sadid recorrl, a stop for controlling the movenent of said record; and a stop-controlling member of a morable bar liaving a shoulder, means for actuating said har, means for actuating said stop-controlling member from said bar, and a finger carried by said arm and arlapted to engage -aid bar near said shoulder.
6. In a talking machine, the combination, with a movable record. an arm movably supported abore said record, a sound-reproducing derice carried by said arm and adapted to move over said record, a stop for controlling the movement of said record and a stop-controlling member, of a two part bar having one part morably comected to the other and forming a shoulder thereon. means for actuating said bar. means for operatively connecting said bar to said stop-controlling member, and a finger carried by said arm and adapted to engage said bair near said shoulder:
7. In a talking machine, the combination, with a record, a morable support therefor haring a projection, a stop for controlling the mowenent of said support, and as soundreproducing device atapted to move orer said reemil. of a bate. a bar movably. mombed on mad base an arm carried bi said bar and operatively comeneded at a point removed from the end thereof with aide sop. means for acthating sad bar to move the cad of aid arm into the patho of
 said smmer-repordmeng device for conteolling the mevement of said har and satd atm.
S. In a talking mathine, the combination. with a movable record, an arme movably -hpported above said record, a sombl-reproducher device carried by matd arm and adaphed to be moved ower mided record. and a s(op) for contwollinge the mosement of satid
 10 mad base ar -pring for :actuating said har. me:ns for operativily comecting salid har to satid sop, and ha part combeded with said arm and controlling the mowement of sald b:ar:
!1. In a tallinge madnine, Hw combination, 115 witl as movalle mende ant arm movably

 adtapled to mowe more aid remord, and al

 at -pring for actarting sadid bar, a linger

 nown :atid lomblar: and at romatedion be 125 twern sill b:ar and mid stop, wherel), said
 said shomblar.
10. In a talking machine, the combination. with a movable record, a sound-reproducing device carried by said arm and adapted to move orer said record, and a 5 stop for controlling the morement of said record. of a two part bar having one part morably comected to the other and forming a shoulder thereon. means for actuating said har, means for operatively comecting
by said arm adapted to engage said bar near said shoulder.

In testimony whereof, we affix our signatures in presence of two witnesses.

DELPHOS C. JELSON. JAMES W. NELSON.
Witnesses:
W. E. Christican,
L. B. McNeal.

$$
982,132
$$

H. G. LEHNERT.

MUSICAL INSTROMENT.
APPLICATION FILED JUNE 8, 1910.
982,732.
Patented Jan. 24, 1911.

$$
\text { FIG. }{ }^{\text {FIG. }} \text {. }
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FIG. 1.


Witresses:
in to Cluland cletrotheras


Invertor: Henry F. Lehnert AFihlellit Goodum

# UNITED STATES PATENT OFFICE. 

HENRY G. LEHNERT, OF PHILADELPHIA, PENISYLVANIA.

MUSICAL INSTRUMENT.

Specification of Letters Patent. Patented Jan. 24, 1911. Application filed June 8, 1910. Serial No. 565,679.

## To all whom it may concern:

Be it known that I, Henry G. Lefneert, a citizen of the United States, residing at Philadelphia, in the county of Philadel-
5 phia and State of Pennsylvania, have invented certain new and useful Improvements in Musical Instruments, of which the following is a specification.
My invention rolates to improvements in
10 musical instruments and particularly relates to horns, cornets, bugles, trumpets and other wind instruments.
The object of my invention is to provide a rlevice which may be inserted into the bell
15 of such musical instruments for the purpose of increasing the volume of sound emitted from the instrument and for correcting any defects in the tone and tune of the instrument.
20 A further object of my invention is to provide means for adjustably securing the device in the bell of a musical instrument.
Referring to the accompanying drawings, in which like references refer to like
25 parts: Figure 1 is a longitudinal section of the bell end of a horn or cornet showing my device inserted therein; Fig. 2 is a perspective view of ny improverl sound increasing device, as shown in Fig. 1, detached; Fig.
303 is a view similar to Fig. 1 showing a different form of my device; Fig. 4 is an end view of the device as shown in Fig. 3, detached: Fig. 5 s is a perspective viow of a still different form of my invention; Fig. 6
35 is a side elevation of a still different form of my device; Fig. 7 is an end view of Fig. 6 ; and, Fig. 8 is a longitudinal sectional view of the bell end of a lom slowing a still different form of my invention 40 inserted in the same.

My invention consists of the member 1 , having wires 2 sermed therefo, which projeat beyond the end of the member 1 and are arapted to be inserted into the bell emd
45 of a musieal instrment ?, for lolding the member 1 in its proper place in the emverl on conical portion of the bell of the musical instrminemt.

The member 1 may be matdo conical or
50 bell shaperl with a comeaved portion or at the rear end thereof as shown in Figs. I and 2. The member 1 is inserterl in the lomen and the wires 2 semmed to sath mem ber 1 are bent mod arljusted so that they
55 will hold said member 1 :against oume side of the bell 3 of the horn, :15 shown in lifig. I
so that the concaved portion 5 of the member 1 will be separated from the bell of the horn to form a space between the member 1 and the bell of the horn.

When the instrument is sounded the sound-waves will be divided into two columns, one passing through the main or central opening through the member 1 and the other column of air passing through the space formed between the bell of the horn and the concaved portion 5 of the member 1, which will greatly increase the volume of the sound and tone of the instrument.

Instruments of different sizes and manufacture require different forms of my sound-wave increasing device and some instruments require the device to be so placed in the bell thereof that the smaller air passageway will be formed at the top of the bell, as slown in Fig. 8, instead of at the bottom, as shown in Fig. 1.

It is desirable to make the device so that it may be adjustably secured in a horn. The wires $\mathscr{y}$ attached to the member 1 are capable of being bent to hold the member 1 in any desired position in the horn and said wires have suflicient rigidity to bold the member 1 tightly against the bell of the s: horn to procent any viluration or rattling when the instrument is somnded.

The form of device slown in Fig. 3 has the member 1 made with a exlindrical body. having a cut-a-way portion of to allow the 90 somid-vaves to pass between the member I and the bell of the hom. Fig. 5 illustrates a device difforing from that shown in Figs. 1 and 2 only in so far as the portion 5 is made flat instead of coneswed and is befler as sutal for some partiontar instrments.
The form shown in litus. 6 and 7 illustrates ant clliptial member I which is : 1 laped (0) divide the somblwane into Three colmmes sa! and 10. The follad 1 m abelo slow in in big. 7 repmesents the mosssection of the horis at the points of comtad with the member 1 and Fige \& illustratio 11 conical member 1 having fle wires $\because$ bent to hold satd menther mainst one side of 10 , the bell is of the instrmment.

Fiach of the whowe forms of devies has beron foumd to be befter mated to partioular forms and sizes of instruments and I thereforre do not wish to limit my innomtion (10 110 ally partiontar shape of sombil wand divis ing members.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. In a sound producing instrument hav5 ing a horn, a sound wave dividing member consisting of a hollow tube having a portion of its inner end curved to conform with the cross section of the horn and adapted to be held in contact with the inner surface
10 of said horn, said tube having a portion of the periphery of the inner end thereof shaped so as to form a passageway between the tube and the inner surface of the horn and means for adjustably holding said 15 tube in said horn.
2. In a sound producing instrument hav-
ing a horn, a sound wave dividing member consisting of a hollow tube having a portion of its inner end shaped to conform with the cross section of the horn, said tube hav- 20 ing a portion of the periphery of its inner end shaped to form a passageway between the tube and the inner surface of the horn and wires secured to the inner end of said tube and projecting therefrom for adjust- 25 ably holding said member in the horn.
In testimony whereof I affix my signature in presence of two witnesses.

HENRY G. LEHNERT.
Witnesses:
Arthur G. Penton, M. R. Cleeland.
J. JESTER.

STYLUS OR NEEDLE FOR SOUND RECORDING AND REPRODUCING MACHINES.
APPLIOATION FILED AUG. $2,1806$.
983,061.
Patented Jan. 31, 1911.


# UNITED STATES PATENT OFFICE. 

JULIUS JETTER, OF CAMDEN, NEW JERSEY.

## STYLUS OR NEEDLE FOR SOUND RECORDING AND REPRODUCYNG IVACHINES,

Specification of Letters Patent. Patented Jan. :31, 1911. Application filed August 2, 1906. Serial No. 328,955.

## To all whom it may concern:

Be it known that I, Jones Jemper. a citizell of the Cnited States, and a resident of C'anden. Camden connty: New Jersey, have 5 invented an Improved stylus or Needle for Found Recording and Reproducing Machince of which the following is a specifi(ation.

My invention relates to the somul record-
10 ing and reprochacing mechanisun of phonographe and other somad recording and reprochecing instrmments. and it consists of an impored form of strlus or meedle applicable nume particularly to the reproduc15 lion of somud from disk records.

My invention comprixe finther means for adjuisting on feeding such stylns or needle wherely all wear mpon the same is compensited fors.

In the acconupaling drawinge illostrating my incmion: Figure 1 is a view in delvation of a sombl-box carring the improved form of stylas forming the subject of my invention. Showing the -anme in the
25 position of use and showing aloo. in dotted lines, the pesition of the somel-hox when it becemes nerestany to feed the needle or Hlus forwad, and Figs. $2,: 3$, and $t$ are

 whe m! invention. comsists of hard stem

 lit Hie gromer al lle remed. 'This wire.
35 Enlicatal at 1 in (1世 : acompanying dran-
 2. cheireling the (an-inge: of the sumblow.



 piojoch hevold the cold of thr jalws, sulli-


55:











pecord. and when this lifting is done the feeding operation may take place.

Di-posed in proper position with relation to the jalls carrying the stylus when 60 the somm-box on reproducer is lifted and swung en itspint, are pawls 15 and 16 carried by a piroted and adjustable stem 1i, "hlich has inco a pair of fingers 15 disposed in suld position as to pass orer the jaws 465 and is and chgage the spring (s normally closing saded jaws, and displace it to a certain extent. The hearl carrying these pawls and fingers is also slotted at 19 for the passalge of the needle or stylus point. When the release of the spring 6 takes place, one of the pawls engages the milled wheel 10 in engagement with the needle or stylus and the other pawl engages a supplementary wheel 20, also milled. carried on the stem or spindle 21 of the other milled wheel 11 in engagement with said needle or styhs. The total movement efiected by the pails is very slight. but it is emomg to keep the strlus projected a mefficient distance for the work. therehy awoding the constant replacing of new points as is common with the sommboxes or reprochcers in ordinary use.

The tube $\because$ containing the irire. Which may be of rublere is prefurally lechl down ss ly a sllitable clamp sin. annl if (lexireal al momlime of these dampa may he dixposed arommed


1 (lilin:


 *






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 - \% W1: :




 aill jall:-


of a continuous stylus, means for feeding the same. jaws between which the stylus is disposed, and means for closing said jaws, such means being engaged by the feeding mechanism to cause the jaws to open slightly.
5. The combination with a sound-box for sound recording and reproducing machines, of a continuous stylus, means for feeding the same, jaws between which the stylus is
10 led, and a spring arm for closing said jaws, said arm being engaged by the feeding mechanism to permit the jaws to open slightly.
6. The combination with a sound-box for 15 sound recording and reproducing machines, of a continuous stylus of wire encircling the sound-box casing.
7. The combination with a ssund-box for sound recording and reproducing machines, circling the sound-box, and a covering for the same.
8. The combination with a sound-box for sound recording and reproducing machines,
25 of a continuous stylus of wire, a tubular covering inclosing the same, and means for feeding said stylus, the covering being discontinued at the point of engagement of the feeding means.
9. The combination with a sound-box for sound recording and reproducing machines, of a continuous stylus of hard steel wire, a tubular covering inclosing the same, and means for feeding said stylus, the covering
35 being discontinued at the point of engagement of the feeding means.
10. The combination with a sound-box for sound recording and reproducing machines, of a continuous stylus, a pair of jaws be-
40 tween which the same is led, feeding wheels in engagement with said stylus, and means for operating said wheels.
11. The combination with a sound-box for sound recording and reproducing machines, 45 of a continuous stylus, a pair of jaws between which the same is led, milled feeding wheels in engagement with said stylus, and means for operating said wheels.
12. The combination of a sound-box for

50 sound recording and reproducing machines; a pirotal mounting for the same, a continnous stylus, jaws between which the same is led, milled wheels carried by said jaws in engagement with the tylus, and means in
55 the path of movennent of the sound-box on its pivot for engagenent with said milled wheels whereby the stylus can be fed through such engagement.
13. The combination of a sound-box for
sound recording and reproducing machines, 60 a pivotal mounting for the same. a continuous stylus, jarss betreen which the same is led, milled wheels carried by said jatrs in engagement with the stylus, and pawls mounted in the path of the sound-box when turned on its pirot for engagement with said milled wheels whereby the stylus can be fed through such engagement.
14. The combination of a sound-box for sound recording and reproducing machines, a pivotal mounting for the same, a continuous stylus, jaws between which said stylus is led, milled wheels engaging said stylus, pawls for engaging said wheels, a stem carrying said pawls, and a pirotal mounting for the same.
15. The combination with a sound-box for sound recording and reproducing machines, of a pirotal mounting for the same, a continuous stylus carried thereby, jaws for guiding said stylus. milled wheels for feeding the stylus, a piroted member having pawls for engagement with said wheels to move the stylus, a spring teuding to close said jarts. and projecting means carried by said pawl carrying member for engaging said spring, releasing the jaws and permitting the stylus to be fed through the same.
16. The combination of a sound box for sound recording and reproducing machines, a continuous stylus, a protective covering for the same, jairs carried by said sound box between which the strlus is disposed, said protective covering being discontinued adjacent the jaws, and movable means directly engaging said stylus for feeding the same longitudinally between said jaws.
17. The combination of a sound box for sound recording and reproducing machines, a continuous strylus, jaws between which the stylus is disposed. means for feeding the stylus longitudinaliy throngh said jaws. and means for closing said jaws.
18. The combination of a sound box for sound recording and reproducing machinies. a continuous stylus, self-closing jaws carried by said sound box between which the strluis fed longitudinally. and morable means directly ellgaging said stylus to impart the longitudinal morement to the same.

In testimony wherenf. I have signed my name to this specification. in the presence of two subscribing witnesses.

## JULIUS JETTER.

Witnesses:
Fredrick Furster, William Jetter.
W. W. MoCAULEY. PHONOGRAPH.
APPLIOATION FIEED MAY 5, 1910.
983,155.


Patented Jan. 31, 1911.

# UNITED STATES PATENT OFFICE. 

WILLIAIV W. McCAULEY, OF IVADRID, IOWA.
PHONOGRAPH.
983,155.
Specification of Letters Patent. Patented Jan. :31, 1911. Application filed Nay 5, 1910. Serial No. 559,513.

## To all whom it may concern:

Be it known that I. Wildias W. McCauLet, a citizen of the United States, residing at Madrid, in the comnty of Boone and State
5 of Lowa, have invented a certain new and useful Phonograph, of which the following is a specification.

My invention relates to that class of phonographs in which the reproducing disk
10 is provided with a weighted extension to yieldingly hoid same in engagement with a phonographic record.

My object is to proride a derice in the nature of an attachment that may be applied
15 to phonographs of this class to apply a yielding pressure to the reproducing disk in order to yieldingly hold the reproducer to the record so that shocks and jars to the phonographic instrment will be prevented
20 from throwing the reprodncer out of its proper path of travel on the phonographic record so that in using extremely hard records of the kind ordinarily called indestructible reedrds the follower may be held
25 firmly to the record to thereby more accurately reproxhece the somuds than is possible with a reproducing instrment that is held toward the record hy a weight only:

My oldject is further to provide comsen-
30 icut means for adjusting the spring tension to med the requirements of use.

My imention consists in vertain details. in the construction, arrangenent and combimation of the varions pats of the derice.
35 wherely the uljects contemplated are attainerl, as herematter mome fully ser forth, pointed ont in my cham and illustrated in the accompanying drawings, in which:

Figure 1 shows a sertional view of a palt
40 of :an ordinary phomograph lating my iutpood opring presshre applane embered therewith. Vig. 2 shows an enlamed, detail view of the ame that -inports Here producer of a phomograph with my in45 prowed jpring attachoment applied thereto. F"ig. :3 shows as sectinnal view on the line 3-: of Fig. 2, and lig. 1 shows a side clevation of the attandment disemmederd fiom the photegraphice instroment.

Reforming to tha arompanying draninge 1 have nsed the reformer minteral 10 to in dicate Hur frame wi a phomegraph, 11 the


fis stidingy momed upon at gute 11 . The


16 is pirotally connected therewith and prorided with a weighted extension 15 to yicldingly hold the cli-k 16 toward the record. All of the parts above described are of the 60 ordinary construction now in general use and a further detailed description thereof is deemed unnecessary.

My inprotement consists in the nature of an attachment that niny be applied to any 65 of the phonographes of the class above mentioned.

It consists of a metal biock 18 designed to fit against the under surface of the arm 13. It one side of the block I have fixed a metal strap 19 which is designed to pass over the reproducer arm and which is provided with a set screw 20 having its end seated in the side of the block 18 opposite from: the side to which said strap is fised so that the bleck may be adjustably and detachably connected with the arm and sot that it may be firmly fixed in any position in which it is placed. Extended through the block is from its mader side is a set serew 21 for purpores 8 hereinafler mate clear.

The spring for rngaging the reproducin! disk comprises a cinted body portion having one end inserfed between the blods 18 and the arm 13 ame preferably provided 85 with a romaded lug 2:3 (1) engage ine aron 13. The other cud of the spring is plawed in
 tension 1 l and is preferably phamed in a sumall growse in said extemsion di to therely 90 prevent lateral movement of the extem-ion relative for fle pring. The arangement of This spring is such that it tem-ion, as applied to the extension 1i. alat be adjustad
 sermer 2l. In addition (1) this 1 hato provided means whereds the stiding ramage


 (1) He otber as lollons: In the gnide 11. 1


 (1) culcr sad slol :and la somding! held 105







the block 18 may be readily, quickly and easily attached and firmly secured in position on the arm of a phonographic instrument with the spring 22 thereof in engagement with the weighted extension 17 of the reproducer. The tension of said spring may be raried to suit the requirements of an adjustment of the set screw 21. I have found that with a reproducer having a weighted extension only, any jarring motion applied to the support on which the phonograph stands will tend to cause the reproducer arm to vibrate up and down to an extent sufficient to interfere with the reproduction of sound and in some instances the reproducing point will even move laterally relative to the record out of its normal path of travel, thus wholly interrupting the continuous reproduction of sounds as re20 corded on the record. The application of the spring serves a number of important functions. First, it will yieldingly hold the reproducer toward the record in such a manner as to prevent rebound of the reproducing point relative to the record and in addition to this it prevents lateral movements of the reproducing disks and point so that the point will not pass out of the groove in the record even though the instrment is moved
of the normal path of travel on the record and I have found that by means of the improved spring attachment the reproducing point may be guided more accurately and held more firmly to the record than by the use of the weighted extension alone regardless of the amount of the weight.

I claim as my invention:
The combination with a phonograph having a reproducing disk and a weighted extension connected with said disk for normally holding the reproducing disk toward 50 a record, said weighted extension being provided with a notch in its upper surface and an arm for supporting said disk, of a block placed adjacent to the under surface of the arm, a flexible strip fixed at one end to the 5 block, and passed arcund the top of the arm and having a set screw therein seated in the block for adjustably and detachably securing the block to the arm, a spring having a rounded lug thereon interposed between the block and the arm with its rounded lug in engagement with the arm, a set screw seated in the block to engage the spring, the said spring being extended to position with its free end resting in the notch of said weighted extension for applying a yielding pressure to the weighted extension and for limiting the lateral morements of said weighted extension, substantially as and for the purposes stated.

Des Moines, Iowa, March 12, 1910.
WILLIAMI W. McCAULET.
Witnesses:
Mary Wallace,
IV. A. Loftus.

973,123
E. M. TURNER.

PHONOGRAPH,
983,183.
APPLIOATION FILED DEC. $27,1909$.
Patented Jan. 31, 1911.
3 SHEETS-SHEET 1.

E. M. TURNER.

PHONOGRAPH.
983,183.
Patented Jan. 31, 1911.
3 SHEETS-SHEET 2.

E. M. TURNER.

PHONOGRAPH.
983,183.
Patented Jan. 31, 1911.
3 SHEETS-SHEET 3.


# UNITED STATES PATENT OFFICE. 

ESTEY MIURRELL TURNER, OF PASADENA, CALIFORNIA.
PHONOGRAPH.
$\mathbf{9 8 3}, 183$.
Specification of Letters Patent. Patented Jan. 31, 1911. Application filed December 27, 1909. Serial No. 534,920.

To all whom it may concern:
Be it known that I, Estey M. Torner, a citizen of the United States, residing at Pasarlena, in the county of Los Angeles and
5 State of California, have invented a new and useful Phonograph, of which the following is a specification.

This invention has reference to improvements in phonographs and is designed to 10 produce a machine of this character with which the sound may be recorded or reproduced to as great an extent as desired even thongh far exceeding the linits of the record tablet, the structure being such that when
15 the record on one tablet is atome exhausted or the limits of the tablet are about reached, a second tablet will come into action antomatically so that during the recording or reprorlucing of the sommeds with the seeond
20 tablet a thind tablet may be placed on the machine after the remosal of the first tablet and on! the completion of the second tablet the third abled will be antomatically introdneed into adtion. and this operation may be repeater indefintely so long as the operaterr desires.

The invention will be best muderstond from a consideration of the following detail deserpiption talen in conneredon with the
30 aceompanying drawings forming a part of this specificalion. in which drawings,

Figure 1 is a side elevation of the madnine. Fig. 2 is a contral vertienl section lompritndinal of the machine. Fig. 3 is a phan view 35 of the machin.( Fig. 4 is a seetion om the
 view of a sleme or alapter. Figig. if is all end


40 view of one of the remend mathede illasthating the lack for har wewd tabled. lig. () is a deditl biow of the medanism for op) arating fle fored nul.

Reforving to the drawines ther is shown










the end of the base 1. These sleeves termi- 55 nate at the ends or have secured to their ends ball cups 7. Mounted within the sleeves 6 are other sleeves 8 extending at each end through the ball cups. At one end, that is the end toward the middle of the base each sleeve 8 carries a ball cone 9 which may be attached to or form part of a clutch member 10 also mounted on the sleeve in fixed relation thereto. The other end of the sleeve 8 carries another ball cone 11 attached to or forming part of a hub 12 carrying at the end remote from the ball cup one end of a cylindrical mandrel 13 projecting over the sleeve 6 in concentric relation thereto and toward the middle of the base 1 .

Entering the end of the sleeve 8 carrying the mandrel 13 is a screw pin 14 terminating at the imer end in a point 15 while at the outer end this pin is entered by a tapered serew 16 forcing it into firm engagement with the corresponding end of sleeves s thas miting the pin $1 f$ to the sleeves in such mamer that the pin may be adjusted longitudinally of the steeve and then locked by the serew 10. The pin 14 is shown as provided with a portion 15 ha ving serew threads formed thereon and this portion is designed to enter a comporspongly theaded portion of the interior of the sleeves.

Extendiner hetween the lacingends of the sleeves 8 is at shaltis having its intemediate portions prowided with serew thrade as shown at 19, this intermediate pertion toing perferably of greater diameter han the reat of the shat and the wew the ats are of a pilch suld a is is minally employed in somad recording and reprodneing machines. The
 alld coller the rompopombling cmis of the shereses and the extreme emels of the shatif
 pins 11 cmtering emter (mp) in the and of
 11 wring the centering hatimgs for the

 menth of which rotative mosment mus ho

 diombe of any mumere of cansing the mo tation of the slaff is cither her helf of wher wisi.

It the purtions of the shaft is miljucent
to the clatch members 10 are other clutch members 21 constrined to rotate with the shaft each by a spline 22 but which clutch members may be moved longitudinally of the respective clutch members 10 so that either one of the mandrels 13 may have rotative motion imparted thereto as may be desired.

Mounted on the rods 3 at each end of the machine is a carriage composed of two sleeres 23,24. The sleere 23 is mounted on one rod 3 , while the sleeve 24 is mounted on the other rod 3 at the same end of the ma5 chine as is the sleeve 23 , the two slecves 23 and 24 at the same end of the machine being connected by rokes 25 so that the sleeves will move together.

The carriages are capable of moving along dor a distance abont equal to the length of the corresponding mandrel 13 and the length of the screw section 19 of the shaft 18 is such as to impart the appropriate motion to the two carriages as will herein-

25 after appear.

Each rod 3 carries a sleeve 23 near one end and the sleeve $2 t$ of the other carriage near the other end. Mounted on the sleeve 23 at one end of the machine is a tubular
30 arm 26 having an angle neck 27 seated in an annular bearing 28 carried by the corresponding sleeve and the arm 26 is held to the sleeve by a screw pivot 29 extending axially of the neck and entering an appropriate threaded socket 30 carried by the bearings 28. The free end of the neck 26 within the bearing 28 is in communication with another neck 31 similarly mounted in the bearing 28 by means of a screw 32 similar
40 to the screw 29 and the other end of the neek 31 may receive any appropriate somnd conveying conduit whether of the amplifying character or not.

The end of the tubular arm 26 remote fom that formed into the neck 26 carrics a sound box 33 either formed thereon or at tached thereto and this sound box may be of any appropriate character, the construetion of the somd box not entering into the
50 mesent invention. In order that the som box may be manipulated as desired, the arm 26 is formed with a manipulating handle or extension 34. Ittached to the sound box 33 or to the corresponding end of the arm
5526 there is one cud of a lever 35 hinged to the opposite member 23 or 24 of the corresponding carriage and also provided with a manipnlating extension 36 similar to the manipulating extension 34 of the arms 26 .
60
The member 24 of the carriage is longer than the mandrel 13 and for a portion of its length is reduced in external diameter as indicated at 37 in Fig. 4, this rednced portion constituting a seat for a sleeve 38 capa-
ble of turning on the sleeve 24. and this 65 sleeve 38 at the end towart the sound box is provided with an off-set arm 39 having its free end parallel with the axis of rotation of the sleeve and moler-riding the handle or extension 34 so that when the latter is depressed the arm 39) will be engaged by said handle and the slecre 38 will be given a short rotative movement about the axis of the member 24 .

The end of the sleere 24 remote from that 75 carrving the hollow arm 26 in one case and the lever 34 in the other case has a lateral extension or arm 40 adjacent to the serew portion 19) of the shaft 18 . This arm 40 is formed at the outer end with a recess 41 housing a block t.2 provided with a stem 43 projecting into the arm toward the rod : and having its end adjacent to the rod ? bent at an angle to project beyond the corresponding face of the arm 40 as shown at $4 t$. The sleeve 38 arljacent to the arm 40 is provided with a finger 45 shaped to engage the end 44 of the rod or stem 43 in such manner as to cause the longitudinal movement of the block 42 in the recess 41 when the sleeve 38 is rotated in the proper direction. Outside the recess 41 the block 42 is engaged by a spring 46 tending to more the block 42 outward. The block 42 carries a mut section 47 adapted to the threaded portion 19 of thr: shaft 18.

The sleeves 23 and arms 40 are provided with meeting ligs 48 and throngh the corresponding lugs on the same side of the machine extends a rod 49 headed at each end beyond the lugs and capable of moving through said lugs. The lug 48 upon each sleeve 23 also carries an adjustable pin 50 so positioned as to make contact with the other lng 48 on the same side of the machine under conditions which will presently appear.

Mounted on the base 1 beneath the clutch member 21 is a lever 51 , this lever being piroted at one end to the base as indicated at 52 .

Beneath the elutch member 20 is mother 110 lever 53 pisoted at one end of the base as indicated at 54 . Rising from each lever is an arm 55 comnected to the corresponding clutch member 21 or 22 as the case may be so that when the lever is moved on its pirot the clutch member will be moved longitudinally on the shaft 18 into or ont of engagement with the meeting clutch member coupled to the corresponding mandrel. The two levers 51 and 53 have their pirot connections at one side of the center line of the machine and extend toward the other side of the machine where the fiee ends of the levers are connected by a link 56 so that these two levers are constrained to move together. The link 56 near the lever 53 carries an nupwardly projecting pin 57 of sufficient height to be engaged by a lng or block 58 carried by
the arm 40 of the sleeve 24 on the corresponding side of the machine.

Pivotally connected to the link iff near the pin 57 is one end of a lever a! piroted to
5 the base about the center line thereof, that is, beneath the shaft 18 , and this lever extends to the other side of this center line and into the path of the arm 40 of the carriage member 24 on the corresponding side of the ma-
10 chine. The free end of this lever carries a set screw ( 00 st that the relative time of contact of the arm 40 with the lever may be aljuisted.

The accessible end of each mandrel 13 is 15 provided with elastie fingers 61 preferably at diametric points within the mandrel and the free ends of the spring fingers project beyond the free end of the mandrel and are there bent as indicated at 62 to normally
20 project beyond the periphery of the mandrel in the path of a record tablet to be placed thereon. In the partienlar structure shown in the drawings the record tablets cach consist of a motallic slepere $1: 3$, or this
25 sleeve may be formed of any other snitable material, and exterior thereto there is a coating fit of record receiving material of any suitable character. Such a tablet may be reatlily pushed on the mandrel 13 , the spring
30 fingers (i1 yielding to such movement and When the taiblet is on the inanderel to the full extent then the ends fig of the spring fingers smap in the path of the tablet thas holding it on the mandrel.

The end of the mandrel remote from that onto which the lablet is first phaced is provided with a radlal ciremmferential flange (6.) and adjorent (o) this flange the mandrel is provided with a perforation fif throngh 40 which extends the free end of a spring 67 fart to the interior of the mandrel. The sleeve (is) is provided with an end notel bis raterex by a tadial lug (at) on the mandrel adjacent to the spring fis and this spring is
4.5 desigeded thave its fire emdenter the notch
 ness of fit between the motel) of the manderel
 are devigured to canse the baldey to motate
50 will the mather, withont inter formere howare with the rearly remosal of the tablet from the matuled.
 mander may bre made taperinge after the
 whimes. or the mamirel $1: 3$ may her adialied to taldets will inlernal taprers he the cmplay-

Lat it hes assmmel that it is dexrable to



 hand emb of the machime nuld that the simme
is being recorded in the usnal manner. In 65 the position shown in Fig. ? the somd hox has reached abont the limit of its travel toward the right and the arm to of the sleeve $2 f$ of the carrage for the said somed box is bronght into engagement with the screw 60 of the lever 99 and the actuation of this lever by the continned movement of the earriage causes a movement of the le rer 33 in a direction to move the chiteh member 22 out of engragement with the elutch member 10 and thas meoupling the mandrel at the right hand end of the machine, as viewed in Fig. 3 , fiom the shaft 18 which is assumed to be tontimonsly rotating under the action of a suitable power applied thereto throngh the pulley 20 or by means of other driving devices.

As the elutch member 22 is being moved ont of cogagement with the clutch member 10, the clutch member 21 is being moved into 85 engagement with the elutch member 10 of the other mandrel, that is the one at the left hand end of the machine. throngh the link connection iff between the leversis and in The parts may be so adjusted that the conpling of the mandrel at the left hand end of the machine to the power shaf will take place just prior to the maconpling of the mandrel at the right hand end of the machine from the power slaft.

The parts are so adjusted that just prior to the meompling of the mandrel at the right hand end of the machine from the power shaft the rods 19 are oomered by the progressive tavel of the carmage at the bight 100 hand end of the machine as to hame their other emels move the carriage at the left hamd end of the machine a sullicient di=tane (onward the right to bring the mut. if of silid carriage into engagement with the threated 105 portion 1 !) of the shaff is so that :1s the recording at the right hame and of the mat -hine ceases it will hawin at the halt hame and of the madimes. It is proteralole that the reedrdinge shombl herein on the hef hamed 110 (end of the mardine just prim (on wating :
 Here is a slight wiorlappinge. but with the
 terfere with the reprochertion of the smme. 115 The rewording proweals romtimmon Is, :and









 IIt there rixht hathe and of the marhime m:as

machine to a sufficient distance to bring the sound box into operative relation to the initial end of the record tablet, the full tablet having been previously remored and a new 5 table substituted, or this may be done after the carriage has been returned to its initial position. In the meantime the record is being produced upon the tablet at the left hand end of the machine and the carriage
10 there located is moring toward the right. Cltimately this carriage approaches the right hand limit of its travel when the lug ss will be brought into engagement with the pin 57 and more the link 56 in a direction
15 opposite to that in which it was mored by the carriage at the right hand end of the machine at the termination of its travel, and the clutch member 21 will be mored out of engagement with the other clutch member
20 of the mandrel at the left hand end of the machine and the clutch member 22 will be mored into engagement $\pi$ ith the corresponding clutch member of the mandrel at the right hand end of the machine thus starting
25 the mandrel at the right hand end of the machine into rotation. The pins 50 are at the same time brought into engagement with the respective lugs 48 and the carriage at the right hand end of the machine, pre-
30 riously mored to its initial position, will be caused to trarel a short distance with the carriage at the left hand end of the machine, this distance being sufficient to bring the nut $t \overline{7}$ of the carriage at the right hand end
35 of the machine into operative engagement with the threaded portion 19 of the shaft 18. As soon as the second cylinder has receired its record and the mandrel carrying it has ceased to more, it may be remored from its
40 mandrel and another fresh cylinder put in its place ready for an additional record, the carriage and sound box individual to such end of the machine haring been mored to its initial position so that when the preceding record is finished the new record may contime as before. By this means the recording may continue uninterruptedly as long as necessary or desirable.
'The machine thus prorides means for the
50 continuous recording of sound without interruption and the reproduction of such records may be caused on the same or a like machine eren though the composition recorded covers many tablets of a size conrenient to handle.
While the sound conduit for either receiring or amplifying, recorded sounds is not shown in the drawing it will be understood that the two necks 31 will have a common
60 comnection to the receiring or the delivery end of a suitable sound conduit as the case may be.

There need be no interruption whatsoever in the continuity of the record as a whole
eren though it corer many sound record 65 tablets.

What is claimed is:-

1. In a phonograph, a central feed screm, record tablet holders at opposite ends of the screw. clutches between the screw and respective tablet holders, operating means for the clutches acting to alternately more the clutches into position. sound boxes one for each tablet holder. elongated supports for the sound boxes parallel with the longitudinal axis of the screm, a feed nut for each sound box morable therewith and pirotally mounted on the respective sound box support, and means under the control of each sound box support for moving the feed nut of the other sound box into engagement with the feed scretr.
2. In a phonograph, a central feed screw, record tablet holders at opposite ends of the screw. clutches between the screw and respective tablet holders, operating means for the clutches acting to alternately move the clutches into operative position, sound boxes one for each tablet holder, elongated supports for the sound boxes movable parallel with the longitudinal axis of the scrers, a feed nut for each sound box support movable therewith and pirotally mounted on the respective sound box support, means under the control of each sound box support for n:oring the feed nut of the other sound box support into engagement with the feed screw, and manually operable means for returning either sound box support and its feed nut to initial position without interference with the other.
3. In a phonograph, a shaft prorided with an intermediate screw, record tablet carriers at each end of the shaft, clutches between the shaft and respective tablet carriers, rods on each side of and parallel with the shaft, a carriage on and movable along the rods adjacent each tablet carrier. a sound box on cach carriage, a feed nut on each carriage for engaging with the feed scrers, a connection from each carriage to the other actire to cause movement of the inoperative carriage to engagement with the feed screw as the active carriage approaches the limit of its active morement, and clutch-operating means controlled in turn by each carriage to caluse one clutch to engage and the other to disengage.
t. In a phonograph, two parallel spaced carriers. and a carriage adapted to travel thereon and composed of two rigidly joined supporting members in separated parallel relation mounted on and capable of movement together along the carriers, a soundbox intermediate of said two carriage members. a sound conveying tube carried by the sound box and pirotally supported on one of the carriage members at the end remote
from the sound box, and a manipulating member for the sound box pivotally supported on the other carriage member and extending from the latter to the sound box 5 and there pivotally commected to said sound box.

In testimony that I claim the foregoing as
my own, I have hereto affixed my signature in the presence of two witnesses.

EがVEI MURRELL TURNER.
Witnesses:
Newton Burkilardt, C. M. Turner.

983,416
W. W. YOUNG.

ACOUSTIC DIAPHRAGM,
APPLICATION FILED FEB, 18,1910
983,416.
Patented Feb: 7, 1911.


Fig. 1.


Fig _己


Fie. $\mathrm{f}^{2}$
 a. C.Gairbankes. JIF.7 g. $D$ oixrian

William W. Young, widen te.

ATTORNEYS.

# UNITED STATES PATENT OFFICE. 

WILLIAML W. YOUNG, OF SPRINGFIELD, IMASSACHUSETTS.

ACOUSTIC DIAPHRAGIM.

$983,416$.<br>Specification of Letters Patent.<br>Patented Feb. \%, 1911.<br>Original application filed January 23, 1909, Serial No. 473,819. Divided and this application filed February 18, 1910. Serial No. 544,659.

To all whom it may concern:
Be it known that I, Whliam W. Young, a citizen of the United States of America, residing at Springfield, in the county of
5 Hampden and State of Massachusetts, have invented a new and useful Acoustic Diaphragm, of which the following is a specification, the same being a divisional part of United States application for patent, Serial
10 No. 473,819, filed January 23, 1909.
My invention relates to improvements in acoustic diaphragms for talking machines, relephones, and the like, and consists broadly of a large diaphragm or diaphragm proper
15 provided with one or more lesser diaphragms.

The object of my invention is to produce an acoustic diaphragm, of the class indicated above, which possesses in a marked degree not only the essential but desirable characteristics and qualities of a device of this kind, such as durability and stability, resiliency and resonance, capability of giving out clear, lond and distinct tones of great vol25 ume and depth, and of evenly distributing the sound waves and quickly, completely and perfectly recovering its stable equilibrium, and immunity from blasts and scratching sounds and other alien and discordant noises.

In the accompanying drawings, which form part of this application and in which like characters of referenee indicate like parts thronghout the several views, Figures 1 and 2 are side elevations of two of my
35 diaphaggens, showing different formations and arrangements of the kesser or minor diaphagmas, and Fiqs. 3. 4, ,, 6 , 6 and 7 are ser-
 larged or exageraled scale, illusiating dif-
40 freme emblinations or arrangements of the diaphragn-forming elements.

This diaplaragn may be made in several diflerent was, as will presently appear, withont, however, departing from the gen-
Referving first to Jig.g. 3, it will be seen that a diaphragro is there represented which eonsists of a disk 1 , of what may be termed the base material which enters into the con-
50 struction of the diaphragra, in which are " momber of perforations 2, and having firmly
attached to both sides thereof two integuments 3. These members constitute the diaphragm proper or major diaphragm, in which are lesser or minor diaphragms 4 consisting of those portions of the integuments 3 which extend across the perforations 2.

Slight modifications of the diaphragm described above appear in the next three viers, in which Fig. 4 shows a diaphragm proper which comprises two perforated disks 1 with a single integument 3 between to form the lesser diaphragms 4; Fig. a shows a diaphragm proper which comprises a perforated disk 1 and two integuments 3 and 5 of different materials on one side of said disk to form the lesser diaphragms 4; and Fig. 6 shows a diaphragm proper which comprises a perforated disk 1 and two integuments 3 and 5 of different materials on opposite sides 70 of said disk.

That in so far as the merits of my invention are coneerned one diaphragm is as good as another and that all are. to all intents and purposes and from a patentable standpoint. substantally alike are self-evident facts.

In Fig. 3 diaphragm the integuments 3 should be pressed into the perforations "2 and into conlact with each other, this being done at the time the diaphragn is made. so that in the finished diaphagm the portions of sath integments that are in sall perforatdoms and which form the lesser diaphatems I will be firmly stack of wimented fogether amd will therefore be tronge and dimable. And in the Fig. of diaphragm the intergment. $?$ is pressed into the perforations o. at the
 thuse pertions of the intugnoment is which rower sall perforations, as shown.

Yarims matorials for the diak I may lou (muphesed, ammer which mention is matio of mica, wire gatm, shentometals sum as alnminmm, stect, wi, and fibrons maldrials such

 like. 'The "mploviment of shev-iron amel some oflew metals monders the diaphagm fit

 holes in the di-k I, amd they may he of vari-

form regular or irregular, and more or less numerous. In the first two riews there are shown lesser diaphragms 4 which are outlined by perforations that differ considerably, and from this it is clear that there is almost no limit to the different designs that may be given such perforations both as to outline and arrangement.

The diaphragm in each case is not only 10 coated with a snitable material or combination of materials at the time the integument or integuments are attached thereto and for the purposes of effecting such attachment, but also after the several parts have been thus united, so that the exterior of the finished diaphragm consists of such material or materials. The material or combination of materials used for thus coating the disk or disks 1 and the integument or integuthat the same will adhere firmly to the base material of the diaphragm, that is, the disk or disks, and cause the integument or integuments also to adhere firmly to said base
25 material or to each other, and where integuments are employed on opposite sides of the disk to cause them to stick together in or through the perforations 2; furthermore, the nature of the coating must be such that harden during the process of manufacturing the diaphragms as to produce the stable and otherwise excellent derice sought for. I hare found that a coating which consists
35 of silicate of soda, oxid of zinc, plaster of Paris and barytes, gives most excellent results, the silicate of soda comprising about $95 \%$ of the emulsion thus produced, and the other ingredients comprising the other $5 \%$
40 in proportions of about one-third each. This emulsion is applied to the other elements and is pressel and baked thereon, with the result that it cements such elements together and mintes with them, eren when
45 the base material or one of the integuments or both is or are metal. The diaphragm thus produced possesses the qualities hereinbefore enmerated. I do not intend to confine myself, however, to any particular coat-
50 ing material or materials since the range of materials useful for this purpose is large. In this connection baking japans and rarnishes may be mentioned as suitable materials for the coatings.

Tissue paper, silk, linen, and varions other thin fabrics are exceedingly well fitted for the integument or integuments 3 out of which may be formed or by means of which may be produced the lesser diaphragms 4 .
60 These fabrics take the coating evenly, adhere firmly to the base material, and furnish lesser diaphragms of the right character. For the integument :, which also may enter into the formation of the lesser dia-
phragms 4. as stated. I prefer to employ 65 very thin metal such as metal foil, because this takes the coating well. and the results obtained therefiom aconstically are of the best, even when the foil is used alone without the fabric. as it may be.

With some metal disks and integnments and the aforesaid emulsion, while the latter does not, of course, enter the metal as it does fiber and fabric to a greater or less extent, nevertheless said emulsion apparently forms a chemical compound with the metal when baked, and probably does-in any erent, the acoustic properties of the diaphragm are greatly enhanced by the emulsion coating applied thereto and fixed thereon.
The perforations 2 are made in the disk 1 when said disk consists of wire-gauze just the same as when it consists of material which is imperforate originally:

It is not imperative that two integuments, When that number is used, shall meet or be united in or through the perforations 2, although the structure is stronger when they are so united and it is thought that the desirable acoustic properties of the diaphragm as a whole are increased or improved thereby.

Each of the diaphragms proper or major diaphragms shown in the drawings includes a plurality of lesser or minor diaphragms, t. but there might be only one minor diaphragm in each case and that one may be of any suitable size and shape.

In addition to the rariations already noted herein others may be made in my invention provided the scope of the claim be not exceeded. As examples of such additional rariations, I desire to call attention to the following, from which it is obrious that the different combinations or arrangements of the disks and integuments that may be resorted to are quite numerous. The metal foil integument 5 may be sulostitnted for the fabric integrment 3 in the Fig. 4 arrangement, or said integument may be introduced into the Fig. 4 arrangement while still retaining said integument 3. In this last example, however, instead of combining only the tro integuments 3 and $\overline{5}$, as in Fig. ©ั, with the second disk 1 added, I may introduce a second integrment 3 so that the integument 5 shall be between the troo integuments 3 and these three between the two perforated disks. Fig. 7 illustrates the lastmentioned arrangement or combination. Foil integuments 5 may be used in the Fig. 3 arrangement, but they need not necessaril! meet in or throngh the disk perforations.
What I claim as my invention, and desire to secure by Letters Patent, is-

As an improved article of manufacture, 125 an acoustic diaphragm, of the class described, consisting of a plain disk haring a plurality of openings therein between the
central portion and the periphery thereof, such openings being so located as to leave intact both the central and edge portions of said disk and also to aroid separating the
5 disk into independent parts, an integument applied to said disk across said openings: and a lardened coating between and on the
outside of said disk and integument, the latter being thimner than the former and forming with said coating lesser diaphragms.

WILLIAM W: YOUNG.
Witnesses:
F. A. Cutiter,
A. C. Fambanis.
E. MoLAREN.

TONE MODIFIER.


Firig. 3.



Hitriesses. Guthor Le Sleer. firthur while

# UNITED STATES PATENT OFFICE. 

EDWARD McLAREN, OF OAKLAND, CALIFORNIA.
TONE-MODIFIER.
983,509.

Specification of Letters Patent. Patented Feb. \%, 1911. Application filed June 18, 1910. Serial No. 567,627.

## To all whom it may concern:

Be it known that I, Edward McLaren, a citizen of the United States, residing in the city of Onkland, county of Nlameda,
5 State of California, have invented a new and useful Improvement in Tone-Modifiers, of which the following is a specification.

My invention relates to tone modifiers for phonographs and has for jts object the
10 modification of the reproduced vibrations enmating from the record throngh the medimm of the reproducing needle and its connections with the reproducing diaphragm, the sequence being softer in tone without
15 diminishing the namber of reproduced yibrations. I accomplish this by the device illustrated in the drawings appended herewith, in which-
Figure 1 is a front eleration of the "repro-
20 ducer" of the phonograph, with my device attached and in contace with the vibrator: Fig. 2 is a side eleration of Fig. . 1. Fig. .s is a riew similar to Fig. 1, showing the tone modifier attarthed to the "reproducer"
25 hut not in contact with the vibator. Fig. $t$ is a rear view of the modifier detached, with the fingers extended. Fige is is a similar view with the fingers clowed.
 30 law metal drom hav ving a din hat diapha: gm $\therefore$ (1) Ha a 1 ppoximate renter of which is
 mating in a balanced contact piece + , to which is seemed the weetle 3 .
By cansing the needle of to remain in contact with a rewalsing "rerond", the vibuation of the meom is ieproxuced thromphe the needle a. danmimiterd thomegh the piere 4 and vibuator arin :3 to the diaphatis! 关: where the vibations are erverty internsifion ly reason of the greatly inemeasel area of
 phere. Thas far the 11 echamism is common
 noeramplis of the la:t disk itye.
My intontion hase to dio will tha modi-

 ery of the droms 1 , wh hass sermond to its 川r-




 (1) the lawer purtion of the spider if extend-
ing through the same and terminating in a shouldered piece 12 , which extends between the fingers 9 . The piece 12 , when lying with its greater width parallel to the fingers 9, allows said fingers to close together and grip the ribrator arm 3. This brings the vibration absorbing material on the fingers 9 to come in contact with the ribrator arm 3 and partially absorb the ribrations which have been reproduced therein. While this does not reduce the rapidity of the ribrations, it tends to reduce their density, thereby producing a softer tone. By making a quarter revolution of the thumb piece 10, the greater dimension of the shonldered piece 12 is brought between the fingers 9, forcing them apart and ont of contact with the vibrator 3, allowing the full density of thic vibrations as reproduced. to pass to the diaphragm !. It is obvious that by absorbing a portion of the vibrations, any har:hncss or mechanical vibrations will be reduced in proportion, giving a sofler and more harmonious tone.

The details of construction are so susecptible to variation, that I do not wish to confine myself to the precise const metion shown herein, but rather to arail myself of any monlification that may fall pronerly wibhin the sop) of my invention.

1h:a ving thas dereribed me inmention, what.
 ters Patent is -

1. In a tone moxifier, for phonographic reproducers, the combination of a frame adapted to chegage the repredtues a hifurcatcel epring secomed to the hack of the frame and admpted to congage the vibution tramsmitter and as shondered thmols piere interposered between the bifurations :amb adaphed to separate said hilumations from contand with the shatration b:ansmitter. for





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 tw of the homizontal hal two sprine lingom


 absmbing material, a modncular pime in-
terposed between the fingers and pivotally secured to the horizontal bar, said rectangular piece adapted to separate the fingers when turned with its greater width perpen-
5 dicular to the fingers, for the purpose set forth.

In witness whereof, I hereunto set my sig-
nature in the presence of two subscribing witnesses.

EDTVARD McLAREN.
Witnesses:
Arthur L. Slee,
Walter E. Rode.
$984789$
E. A. ALLW00D.

NEEDLE FOR SOUND REPRODUOING INSTRUMENTS.

Fic.3. Fic. $4 . \quad$ Fic. 5.


# UNITED STATES PATENT OFFICE. 

ERNEST ALFRED ALLWOOD, OF ALCESTER, ENGLAND. NEEDLE FOR SOUND-REPRODUCING INSTRUIVENTS.

984,\%89.

Specification of Letters Patent. Patented Felo. 21, 1911.
Application filed January 30, 1909. Serial No. 475,244.


#### Abstract

To all whom it may concern: Be it known that I, Ernest Alfred Allewood, a subject of the Kingdom of Great Britain, residing at Alcester, in the county 5 of Warwick, England, have invented certain new and useful Improvements in Needles for Sound-Reproducing Instruments, of which the following is a specification.


The present invention has relation to needles for use with sound reproducing instruments, and comprises improvements whereby the sound reproducing and vibratory qualities are greatly enhanced.

In order that this invention may be clearly understood and more easily carried into practice, reference may be had to the appended explanatory sheet of drawings on which:-
Figme 1 is a front elevational view of one form of the present invention. Fig. 2 shows a side view of the needle illustrated in Fig. 1. Fig. 3 ilhustrates a pointed needle previons to stamping. Fig. 4 shows a modified form of needle subseqnemt to stamping. Fig. 5 is atertical section of the needle shown in Fig. 4. Figs. fi, 7 and 8 are further modifications of the improved needle.

In arrying the present improvements 30 into affect. the needle is preferably formed from a pointed length of metallie wire A, such wire having one or more ratised ridges or rims á fomed by pressing or stamping "pon one side of a fattened enfargement 35 as shown ly F"igs. 5 and 7 , or upon booll sides
as illustrated in the sectional Figs. 6 and 8 , the said ridges or rims being of any suitable section such as semicircular or angular. The metal in the interior of or between the
rielges $a^{\prime}$ is subsequently removed as at $a^{3}$ Fig. 1 or incases in which increased rigidity is required, may be retained in the form of a thin diaphragm $a^{2}$, while a fin or feather $a^{4}$ is formed upon the exterior of the rims $a^{\prime}$.

The needle may be provided with secondary ridges $a^{5}$ across the face in order to supplement the main ridges $a^{\prime}$ while one ridge or rim may be formed upon one or cach side, or multi-ridges as shown in Figs. 7 and 8 may be used.

Having now described my invention, I declare that what I claim is:-

1. A needle for use will sound reproducing instruments having a flattened enlargement with a raised rim or rims thereon, and a fin or feather exterior edge to the said rim or rims substantially as and for the purpose herein set forth.
2. A needle for nise with somed reprodncing instroments having a flathened enlargement, a eentrally depresed diaphragen with a strromnding rim, and a fin to said rim substantially as and for the purpose heremen sict forth.

In witness whemen I have heremonte sed go my hamd int the preselee of two withests.


Whatas H. E. Bumbian.
Ilorave H. Smotr.

## W'itnesses:

$985,+7=$
H. H. BALLARD.

SOUND REPRODUCING INSTRUMENT, APPLIOATION FILED JULY $6,1908$.
985,496.


Fig. 3.

Witnesses
A.10.Tolman.
a. It Meikon

# UNITED STATES PATENT OFFICE. 

HARLAN H. BALLARD, OF PITTSFIELD, MASSACHUSETTS.

SOUND-REPRODUCING INSTRUMENT.
985,496.
Specification of Letters Patent. Patented Feb. 28, 1911. Application filed July 6, 1908. Serial No. 442,781.

## To all whom it may concern:

Be it known that I, Harlan H. Ballard, a citizen of the United States, residing at Pittsfield, in the county of Berkshire, State 5 of Massachusetts, have invented a certain new and useful Improvement in SoundReproducing Instruments, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to improvements in sound reproducing instruments, but more particularly to sound boxes for phonographs, graphophones, and the like. The greatest problem in the construction of these
15 instruments has been to eliminate the metallic somuds caused by the contact of the stylus holder with the metallic portions of the sound box. Heretofore, the bar carrying the stylus holder has generally been sup-
20 ported upon metal projections or lugs upon the rim of the diaphragin holder, and controlled by spring arms also fastened to this rim. This commection of metal parts causes the vibrations of the stylus to be transmitted
25 to the diaphragin holder, and produces the metallic sounds so common to instruments of this type.

In the present invention, this metallic contact has been a voided by means of vibra-
30 tion insulation separating the metallic parts.
One feature of the invention is the simplicity of construction. In plate of spring amms with complicated adjusting screws and locknuts, as has heretofore been used,
35 a malion of resiliont material has been placed between the stylus holding har and the rim of the diaphragm holder: This allons fiee vibuation of the styhis holder, but does not transmit the vibuation to the box,
40 as is the case with the sterel springs now used. This har is preferably fastoned to the rim of the diaplatagm holder ly means of set serews passing throngh apertures in the bar. 'These apertures are preferably of
45 a comsiderably ervater diameter than ihat of the serews 10 allow free viluation of the bar and prevent medallic: contact.

Another feathere is the form of the cmistion mentioned almere. This is preferably
50 wedge shapere so that it ants as at means for tilling, or regnlating the lever which transmits the vilatitions from the stylus holding bar to the diaplatarm.

Heretofore, He diuphrigem has: beem heded
55 betweren two washers within the diaphrarm holder, hut constant nse has cansed it to slide
between these washers and come in contact with the inside walls of the holder. To prevent this, a vibration insulating rim may be placed about the diaphragm, as will be described more fully hereinafter. In the instruments in use at present, the contact point of the vibration transmitting lever has gencrally been fastened to the center of the diaphragm, as this lever has been constructed of rigid material. This comnection is the cause of great inconvenience, as the movement of the lever tears the diaphragm and causes false sounds.

A feature of the invention is a resilient 70 lever which does not require fastening to the diaphragm, as it will follow the motions of the latter, and keep constant contact when properly adjusted.

Another feature is a resilient tip or contact point upon the lever which transmits to the diaphragm a more even tone than is produced by solid tip.

A lever which does not require attachment to the diaphragm allows the use of a great variety of materials in the construction of the latter as great strength is not required. Heretofore, it has been found necessiny to use mica for diaphragms, as this was the only material of sufficient resilieney which contd at all stand the strain. Witl the resilimen lever or tip, paper, isory. celluloid, parclument, or a large number of other materials, might be atilized which would give as good, if mot better resulte, at a less const.

It should be clearly mederstend that the insention is not limital to the romstruchom and arrangoment of parts herein deseribed, as they may be materially varicel withont altaring the invention.

One cmberliment of the insention is:-hown in the acconpanying drawing in wholn:-

Figure 1 , is : top view of llo somad hox
 1. F"ige 3, :1 scttion on is is of lifig. 关, with 100 nll parts almoe the sedion momed.

In the drawings, the diaphration I is held
 (i) which is fusbomed for the latter he memsonf


 Wrem this han ! math the rims is insertend
 resiliont materinl. 'This conshion 11 is mef ambly wadge shat mad 11 ith the namon whe townid the top of the box 5, :s is shown in

Fig. 2, and acts as an adjusting means for lever 12. which carries the vibrations from the bar 9 to the face of the diaphragm $t$.

The stylus carrying bar 9 is provided with 5 apertures 13 and it to allow the thunb scretrs 10 to pass through them, and mesh in the tapped loles 15 and 16 respectively. These apertures 13 and it are preferably cut with their diameter considerably larger 10 than that of the thumb screws 10 , so that the latter may not come in contact with the walls of the former. Also these large apertures allow the tilting of the bar 9 to adjust the lever 12. as will be described herein15 after.

Upon the bar $?$ is the stylus holder 17 haring an aperture 18 in which the stylus 19 is seated, the latter being held in place by means of the set screw 20 . To the pro-
20 jection or ear 21 on the bar 9 , is fastened the lever 12. This lever has a contact point 22 which may be fastened to the diaphragm 4, or may rest upon it. It may be of any suitable construction, but an adrantageous 25 type is shown in the drawings in which a shank 23 . attached to the ear 21 , supports a crook 24 . having at its end the contact point 22. The whole is preferably composed of flat watch spring steel or other resilient lorr the vibrations of the diaphragm. and also move longitudinally with the shank of the lever. This prevents any tendency of the contact point to damage the diaphragm.

The diaphragm is held within the diaphragm holder 6 by the washers 25 and 26 . and may be fitted witl a washer or rim 27 , preferably constructed of vibration-absorption material, about its circumference. This tween the wasliers 25 and 26 , and coming in contact with the metal inner wall of the holder 6.

Betreen the heads of the thumb screws
4510 and the top of the bar ?, it is adrisable to place small washers 29 of leather. rubber. or other suitable material, so that the latter liolds the former more firmly, and prevents the communication of the vibration from the 50 bar 9 to the diaphragm holder.

The method of adjustment of the lever 12 is as follows:-If it is desired to cause the contact point to be pressed more firmly against the diaphragn, the thumb screws
5510 are adranced, causing the heads 29 to press against the bar 9. As this bar is supported by the wedge shaped cushion 11. a pressure upon the former causes it to tilt forward, as the thick portion of the cuslion
60 offers greater resistance than the thin portion. This tilting canses the contact point 22 to be pressed against the diaphragm. If the thumb screws are loosened, the contact point will be withdrawn in the same man-
65 ner. Thus it will be seen that the thumb
screws act as a means of fastening the stylus carrying bar 9 to the diaphragm holder 6 , and as an adjusting means for the lever 12 .

A resilient tip may be placed upon the contact point 22 of the lever 12 . Where a resilient tip or a spring lever is used. it is unnecessary to fasten the lever of the diaphragm. thus allowing greater freedom of action, and causing the instrument to produce sounds which would be too delicate to operate the ordinary type of diaphragm.

What I claim as my invention and desire to secure by Letters Patent is:-

1. In an instrument for producing sound, a sound box, a diaphragm within said sound box. a strlus. a strylus carrier mounted upon the outside of said box, and insulating means between said stylus carrier and said box.
2. In an instrument for producing sound, a sound box. a diaphragm within said box, a stylus carrier movably mounted upon the outside of said box, and an insulating cushion between said stylus carrier and said box.
3. In an instrument for producing sound, a sound box, a diaphragm within said box, a stylus carrier movably mounted upon the outside of said box, and an insulating cushion of resilient material betrreen said stylus carrier and said box.
4. In an instrument for producing sound, a sound box, a diaphragm within said box, a stylus, a stylus carrier, a cushion of resilient material between said stylus carrier and said box, and means for attaching said carrier to said box whereby the carrier shall be free to rock upon the cushion.

5 . In an instrument for producing sound, a sound box, a diaphragm within said box, a stylus, a stylus carrier, means for connecting said carrier with said diaphragm, a wedge sllaped cushion between said carrier and said box, and means for movably attaching said carrier to said box.
6. In an instrument for producing sound, a sound box, a diaphragm within satid box, a stylus, a strylus carrier, a cushion of resilient material between said stylus carrier and said box, and screts passing through apertures in said carrier to attach said carrier to said box.
7. In an instrument for producing sound, a somed box, a diaphragm within said box, a stylus, a stylus carrier, a lever carried by said strlus carrier to comnect the same with said diaphragm, a cushion of resilient ma- 120 terial between said carrier and said box, and adjusting screws passing through apertures in said carrier to fasten the same to said box.
8. In an instrument for producing sound, 125 a sound box, a diaphragm within said box, a stylus, a stylns carrier, a lever carried by said stylus carrier to connect the same with said diaphragm, a cushion of resilient material between said stylus carrier and said 130
box, and screws passing through apertures in said carrier to fasten the same to said box, said apertures being of a greater diameter than the screws to allow the carrier to rock 5 upon the cushion.
9. In an instrument for producing sound, a sound box, a diaphragm within said box, a stylus, a stylus carrier, means for connecting said carrier with said diaphragm, a 10 wedge shaped cushion of resilient material between said carrier and said box, and adjusting screws to fasten caiel carrier to said box whereby said carrier may rock upon said cushion.
10. In an instrument for producing sound,
a somul hox, a diaphragm within said box, a stylus, a stylus carrier, a lever carried by said stylus carrier to connect the same with said diaphragnt, a cushion of resilient insulating materia! between said stylus carrier and said box, and screws passing through apertures in said carrier to fasten the same to said box, said screws being insulated from said carrier.

In testimony wherof I affix my signature 25 in presence of two witnesses.

HARLAN II. BALLARD.
Witnesses:
Jeannette E. Waterman, Luey B. Ballard.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
P. WEBER.

PHONOGRAPH.
APPLIOATION FILED JUNE 5, 1809.
985,716.
Patented Feb. 28, 1911.


# UNITED STATES PATENT OFFICE. 

PETER WEBER, OF ORANGE, NEW JERSEY, ASSIGNOR TO NEW JERSEY PATENT COMPANY, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

PHONOGRAPH.
985,\%16.
Specification of Letters Patent. l'atented Felb. 28, 1911. Application filed June 5, 1909. Serial No. 500,398.

## To all whom it may concern:

Be it known that I, Peter Weber, a citizen of the United States, and a resident of Orange, in the county of Essex and State
5 of New Jersey, have made a certain new and useful Improvement in Phonographs, of which the following is a description.

My invention relates to phonographs, and the object thereof is the provision of an im 10 proved means for mounting the phonograph horn or sound conveying means, wherely the end thereof connected to the neck of the reproducer on the traveling carriage may be permitted to travel with the said carriage
15 in a horizontal line, while the body of the horn or the mouth thereof swings throngh a small angle. This result is achieved preferably by the provision of a rocking support for the horn so shaped as to accomplish the 20 result desired.

Other objects reside in the construction of parts and combinations of elements hereinafter described and more particularly pointed out in the appended claims.
25 Attention is hereby directed to the accompanying drawings, forming part of this specification, in which the same referener characters are nsed thronghont to denote corresponding parts, and in which-

Fignre 1 is a front view of a cabinet having a phonograph mounted thereon and : phonograph horn contained thercin so momited as to emborly my invention. Fig. 2 is a cross section on line 2-2 of Fig. 1,
35 the plonograph and horn being shown in elevation, and Fig. 3 is a detail, partly in section, showing the mamer of connecting the horn to the reproducer neek.

Referming to the drawings, the reproducer
401 provided with stylus 2 , is so momed that. the said stylns may engage the remerd onf the mandrel ?, the latter and the othere parts of the phonomraph beimg supported as by uprights 4 on the (op) 5t of the cathinct on 45 casing 6 . The hom 7 is attached at ite small end to the neek of the repportheer and extends thence downwardly through the (op 5 5inte the eablinet (f, this sedtom of the lom being preferably tapered. 'The hom is lown
50) at right amgles to this sertion within ther (ablinet and forwardly divected to its exit or month emed, the montr pertion of the hombeing preferably bell shapred ns shawn. The lomen 7 has aflixed therede the reveler is
55 which is smperted ly the hori\%ontul surface

3 of the supporting member 10. (initurs 11 are provided on either side of the rocker 8 and a ligg 12 is providerl projecting outwardly from the center of the enrved bearing surface of the rocker 8 into the recess 18, 60 in supporting member 10, this recess being in the form of an inverted $V$, wherehy werthrow of the rocker is prevented.
The en-acting surfaces compriang the bottom surface of the roeker and the bearing surface 9 are so shaped that the upper end of the horn in its travel back and forth with the reproducer from the position shown in finl lines in Fig. 1 to that shown in dotterl lines, does not tend to rise or fall above or below a horizontal line. During this moveinent, the rocker 8 rocks on surface !! the mouth of the horn oscillating back and forth between the extreme po-ition wown by dotted lines in Fig. 1 past the opening 1.1 formed in the front of the calinet. If desired, opening 14 conld be made large enough to extend opposite the month of the hom in all the positions of the latter. of if made of approximately the same diameter as the month of the bom as slown, guiding means could be employed for -monthly gricling to the opening 14 somds juning from the periphery of the hom opposite the elowerl portion of the front of the cabinet when the horn is in its extreme positims.

The horn 7 is connected in the repmendueer 1 by means preferably of a telecoping and a miversal joint comection. Tha horn i at its upper end is formed into a cylindrie:al tube portion 1.5 within which is slidably momed the tube 16 formed at its lowere end beyond the mad of tube 1 th with the ball 15 . whicla is momed on provide miversal motion within the socket 18 of the tulbe 19, which is direetly comectad with the reproduece 1. By means of the telescoping comnection, Hoe reprodmer may be lifted from the reeord in order to change the same, and ly means of the miversal momedion provided, the swinging of the lowerem of the home while the upper end tratels in a strajght line, is allowed for:

It is whions that varions chameres may be mate in m! imbontion withont deproring from the spirit therew, and motodinerys. wish it to loe moteratored thas my insention is limiterl only ly the terms of the appemded cluims.

Having now deseribed my intention, what 110

I claim and desire to protect by Letters Patent is as follows:

1. In a phonograph, the combination of an amplifying horn, a rocking support for 5 the same, and a supporting means having a plane surface upon which said rocking support rests, substantially as described.
2. In a phonograph, the combination of an amplifying horn, a supporting means se- scribed.
(i. In a phonograph, the combination of a reproducer having a traveling carriage, a hor'n connected to the neck of the reproducer and extending downwardly and forwardly from such connection to its mouth, a rocker secured to said hom and a support upon which said rocker rests, the co-acting surfaces of the rocker and support being so
formed that in the rocking movement of the 50 horn the upper end thereof moves in a substantially straight line, substantially as described.
3. In a phonograph, the combination of an amplifying horn, a rocker secured thereto and a support upon which said rocker rests, the rocker being so placed in relation to the horn that the latter will be substantially in equilibrium in any rocking position, substantially as described.
4. In a phonograpl, the combination of an amplifying horn, a rocker secured thereto and a support upon which said rocker rests, provided with guides for said rocker, and means for preventing overthrow of said 65 rocker, substantially as described.
5. In a phonograph, the combination of a reproducer haring a traveling carriage, a horn connected to the neck of the reproducer, and means for supporting said horn so that the end thereof connected to the reproducer neck moves in a straight horizontal line with the carriage while the mouth thereof swings in an arc in a plane parallel to the path of the reproducer, substantially as described.
6. In a phonograph, the combination of a reproducer having a traveling carriage, a horn connected to the neck of the reproducer by a universal joint, and means for supporting said horn so that the end thereof connected to the reprodncer neck moves in a straight horizontal line with the carriage while the mouth thereof swings in an arc in a plane parallel to the path of the reproducer, substantially as described.
7. In a phonograph, the combination of a reproducer having a traveling carriage, a horn connected to the neck of the reproducer by a universal joint, and a telescoping connection, a rocker secured to the horm, and a support having a surface upon which said rocker rests, substantially as described.
This specification signed and witnessed this th day of June 1909.

PETER WEBER.
Witnesses:
Chis. J. Wetzel,
Dier Smith.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patcnts, Washington, D. C."


## UNITED STATES PATENT OFFICE.

## FRANK L. DYER, OF UPPER MONTCLAIR, NEW JERSEY, ASSIGNOR TO NEW JERSEY PATENT COMPANY, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY. <br> <br> PHONOGRAPH-REPRODUCER.

 <br> <br> PHONOGRAPH-REPRODUCER.}$985, \% 36$.
Specification of Letters Patent. Patented Felb. 28, 1911. Application filed March 18, 1909. Serial No. 484,298.

To whll whom it may concern:
Be it known that I, Frinis L. Dyer, a citizen of the United States, and a resident of Upper Montclair, county of Essex, and
5 State of New Jersey, have made a certain new and useful Inrention in PhonographReproducers, of which the following is a specification.

My invention relates to phonograph re10 producers and the object thereof is particularly to improve the construction described and claimed in the application of Louis A. Chipot, Serial No. $4 \overline{4} 4,843$, for phonograph reproducer styluses. filed Janmary 28, 1909. In the application of said Chipot, a phonograph stylus is provided. which is formed with different contonurs in planes at right angles to each other, or at some different angle to each other, so that the stylus as
20 riewed in one direction is narrower than when viewed in the other direction. The cross section of the stylus in one direction is of suitable size and form for tracking a record groove having certain characteristies,
25 and its cross section in the other direction is of suitable size and form for tracking a record groove having different characteristics. The stylus was desigued particularly for use in tracking record grooves having
30) respectively 200 threads to the inch and 100 thearls to the inch, althongh, of comse, it is olvions that it might be nsed in comnertion with record growes having different pitches or different characteristies by modifying the 3.) contomes of the stylus above referved to. This stylus was momed by the satid Chipot in any snitable mamere so that it conld lo shifted reatily thromgh an angle of 90 degrese, or throigh whatever angle was requiaile to permit the sty has to be nsed for tracking the two records of different whaternistics above referred to. The stylns was thons andaped to be nsed in : singel worodncer

45) weight, and a singhe stylne levers ipoon ome and of which is preferatily momblal a holder fore the styhs. In this preferted forms. the holder is rotatably momed mpon the leser. so that by rolation of the hokder, willer em



 be asisly manipulated to motate the holder.

fixed nember, as the floating weight, adapted to co-act with the arms upon the stylus holder in order to limit the movements of the holder and properly position the stylus for tracking the different records. I also preferably provide indicating means to designate the particular record with which the stylus is in position to co-act when one of the arms above described is in contact with its appropriate stop.

In order that the invention may be more fully understood, reference is made to the accompanying drawing in which-

Figure 1 is a side elevation, partly in section. of a phonograph reproduter constructer in accordance with my invention, and Fig. 2 is a bottom plan riew showing the stylus lever, stylus holder and stylus, together with the arms upon or integral with the stylus holder, the stops upon the floating weight co-acting therewith, and the indicating means.

The reprodncer shown in Fig. 1 comprises a somed box body 1 of the usin:al form. and the diaphragin 2 secnect between traskets:3 by a clamping ring t threaded in said bodr. 'The floating weight ? is piroted at o to the pirot block 7 . which is piroted to the body 1 by the minal serew $S$, and the forating weight earries the depending higs ! : in whith is moment the horizontal swew or stucl 10 on which the stylus lever 11 is pivoted. One and of satid lever is commeded to the emper of the diaphergme hye the nisula link 12 mat head 13. The stylus hotder 11 is pisotally: comeded to the eme of the stohe hever distant from the link le in any sutable mamore.
 is rotntably momber whath a reme or passamenay in the sylus lever 11 in which it rlosely fits. Hhe shithe hodler 11 has rine integratly formed therewith $11 \times$ :m extemsion themof the serew lin. The spring mandmer or mesilime wnsher 16 is slippen mom this theanded atme 15 whan the = 15 lin holder is in position in its reces in the st has labere when
 prosinge 11 pon the -pringe mombre thic the holder 11 thas be mere ratmels hed in pani tion. It in: of "womes. whimin thot the hokder 11 might he mombed in the haver 11
 Itwholder 11 with a periphoral thamad which
 bere of the opering.

Preferably, the holder has formed integrally theremith two arms 18 and 19, which, in the case of a stylus having its two distinctive contours in planes at 90 degrees apart 5 from each other, would preferably be mounted at an angle of 90 degrees apart. These tro arms are adapted to co-act with the stops or lugs 20 and 21, which project from the lomer surface of the floating weight. Adjacent to the stops 20 and 21 , suitable indicia may be marked, as the figures 200 and 100 shown in Fig. 2 of the drawings, which indicate that when the arm 19 is in contact with the stop 21 . the stylus is posi-
15 tioned to track a record haring 100 threads to the inch, and when the arm 18 is in contact with the stop 20 that the stylus has been turned so that it is in position to track a record having 200 threads to the inch. It migh lo, otel might be located at different angles, and that the stops 20 and 21 might be differently situated, if the relation betreen the two contours of the stylus and the position therestops is observed. It is, of course, also obrious that but a single arm might be used if the tro stops were so positioned as to co-act thererrith to properly position the stylus for
30 tracking the two types of records. With the construction shown, the arms 18 and 19
form convenient means for easy manipulation by the operator. The stylus 22 may be of any suitable material such as sapphire, and is cemented or otherwise secured in a socket formed in the holder 14.

Having now described mr invention, what I claim and desire to secure by Letters Patent is as folloms:

In a phonograph reproducer, in combina- 40 tion, a stylus lever, a stylus holder carried by said lever, a floating weight on which the stylus lever is mounted, said holder having a pair of arms mounted ninety degrees apart n:orable thererrith. and stops on said floating meight one hundred and eighty degrees apart adapted to co-act with said arms to limit the morement of the holder in either direction, and a stylus carried br said holder and having different contours in planes at an angle of ninety degrees from each other, either contour being in position to track a certain type of record groove when the appropriate arm is in contact with its co-acting stop, substantiall $\Gamma$ as described.

This specification signed and witnessed this 16 th day of March, 1909.

FRANK L. DYER.
Witnesses:
Dyer Smith, john M. Canfield.
P. WEBER.

PHONOGRAPH STOP DEVICE. applioation filed june $5,1909$.
985,717.
Patented Feb. 28, 1911.


# UNITED STATES PATENT OFFICE. 

## PETER WEBER, OF ORANGE, NEW JERSEY, ASSIGNOR TO NEW JERSEY PATENT COMPANY, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

PHONOGRAPH STOP DEVICE.
985,\%1\%
Specification of Letters Patent. Patented Feb. 28, 1911. Application filed June 5, 1909. Serial No. 500,400.

## To all whom it may concern:

Be it known that I, Peter Weber, a citizen of the United States, and a resident of Orange, in the county of Essex and State
5 of New Jersey, have made a certain new and useful Inrention in Phonograph Stop Devices, of which the following is a description.

My invention relates to phonograph stop
10 devices and the object thereof is to provide a simple, novel and efficient meins for stopping the motor of the machine automatically when the reproducer reaches the end of the record or any other desired predetermined 15 point.

Other objects of my invention reside in the construction of parts and combinations of elements hereinafter described in the following specification and particularly point-
20 ed out in the appended claims.
Attention is hereby directed to the accompanying drawings, forming part of this specification, in which-

Figure 1 is a front eleration of a phono-
25 graph provided with my invention, the front of the cabinet of the machine being shown as partly broken away to show the inclosed parts. Fig. 2 is an end riew looking from the left in Fig. 1. Fig. 3 is a detail of con30 struction, and Figs. 4 and in are details showing the positions of the link connections and detent incans when the machine is in "on " and "oll" "positions respectively.

Referring to the drawings, the traveling 35 caminge 1 is slidably momnted on back rod 22 , the curninge carrying reproducer: "3, which (anmes the well known flositing weight, stylus lerer momed thereon, and stylus carried laceresy, in engargement with the record 404 on the mather 5 . The machine is operated in! the well known mamer loy the belt if pasong orex belt where i, which is rotate:d by a mutor, the belt passing over belt wheel ix froms which the: phonograph man45 drel and the feed serew ate rodated.
'The metor wl' the phomgronh is provided will : gowernow disk 10, will which is alaphed (1) (a) and the fridion pad 11 of fell or other 50 (ommentent material. This pad 11 is carrom at there ond of a downandly extending arum
 matery horizontad position and is supperted at its left end, as slomvor in Fig. 1, by tho
pin 14, which extends through the slot 15 in the link 13. At its right end the link 13 is provided with a pin 16 which rests slidably within slot 17 formed in the left hand end of bell crank 18, which is pirotally supported at 19 and provided with an up- 60 wardly directed arm 20 which cxtends through an opening in the top of the casing of the phonograph and has a head at its upper end through which extends the screw 21, the end of which is adapted to be contacted by the traseling carriage at the point at which it is desired to stop the machine, which point may be changed by adrancing or retracting the serew 21 of the member 20 .

The link $1:$ is provided with a camshaped projection extending downwardly from the linwer side thereof, this projection 22 co-acting with the stop 23 to hold the link 13 in ifs "ofl" "position, or that position in which friction pad 11 is out of contact with governor disk 10. Link $1: 3$ has attached thereto the spiral spring $2 t$, the other emed of whicle is secmed to the vationary member 25, whereby a con-lant rendency is exerted on link 18 to move to the right, as indicated in Fige. 1, and apply the hrake lyy the contact of pad 11 on disis 10. 'This movement is prevented by the contact of projection $2 \cdot 2$ wilh stop $2: 3$, but the moment that the fraveling carriage of the phomegraph contate the cime of serew 21 , the left hamd culd of lodl mank is pat vided with slot 15 is mased, the right hamel cond of link $1: 3$ being mised themently he
 link 13 and the slot 17 in the bell wank 15.


 ment, link 13 awimging ahmul pin II an al pivot, amd at the same time slidine in the di reedion of its lomgth acroses the sated pion and alplying Un" pald ! 11 an disk 10 (1) shり tha

 is simply given "slight push to the lep from llan Aloted to the finll lime porition



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Ilaving now described my insention, what
$\qquad$ a 657075

I claim and desire to protect by Letters Patent is as follows:

1. In a phonograph, the combination with the governor disk of a member carrying a
5 friction pad adapted to co-act with said disk to control the same, and carrying a cam projection, means tending to move said pad into contact $\pi$ ith said disk, an abutment coacting with said projection to hold said pad
10 out of contact with said disk, and a bell crank for lifting the end of said member to allow the cam projection to ride orer said abutment, substantially as described.
2. In a phonograph, the combination with the governor disk of a member carrying a friction pad adapted to co-act with said disk to control the same, and carrying a cam projection, means tending to more said pad into contact with said disk, an abutment coacting with said projection to hold said pad out of contact with said disk, a pin carried by said member, a member haring a slot in Which said pin is slidably supported, and means for raising the slotted end of said last named member to lift the end of said first named member to allow the said cam projection to ride over said abutment, substantially as described.
3. In a phonograph, the combination with

30 the governor disk of a member carrying a friction pad adapted to co-act with said disk to control the same, and carrying a projection, means acting on said member tending to move said pad into contact with said disk, an abutment coacting with saic projection to hold said pad out of contact rrith said disk, means slidably supporting said member at one end, means supporting
said member at the other end, and means for lifting said last named means to swing said member pivotally about said first named supporting means and free said projection from said abutment, substantially as described.
4. In a phonograph, the combination with 4 the governor disk of a member carrying a friction pad adapted to co-act with said di-k to control the same, said member being provided with an elongated slot at one end, a pin extending through said slot for slidably sapporting said member, a pin mounted at the other end of said member, a bell crank provided with a slot in which said last named pin rests, an abutment co-acting with a cam projection on said member, a spring acting on said member and tending to apply said pad to said disk, and a traveling member adapted to contact an arm of said bell crank to lift said projection free of said abutment, substantially as described.
5. In a phonograph, the combination with a slidable brake-applying member piwoted and slidable with respect to its pirot, of means tending to slide the said member with respect to its pirot to apply the brake, de- 65 tent means for the member, and means for moring the member pivotally to unlatch the same and permit it to so slide, substantially as described.

This specification signed and witnessed 70 this 4th day of June 1909.

## PETER WEBER.

## Witnesses:

Ciras. J. Wetzel, Dyer Smitif. Washington, D. C."

## L. LUMIERE.

ACOOSTICAL INSTROMENT.
APPLIOATION FILED JUNE 30, 1900.
986,477.
Patented Mar. 14, 1911.


Fig. 3


WITNESSES
Trif: Foutman.

L. LUMIERE.

ACOUSTICAL INSTRUMENT.
APPLICATION FILED JUNE $30,1909$.
986,47\%.
Patented Mar. 14, 1911. 5 SHeets-SHeet 3.


## L. LUMIERE.

ACOUSTICAL INSTROMENT.
APPLIOATION FILED JUNE 30, 1909.
986,477.
Patented Mar. 14, 1911. 5 sheets-sheet 3.

L. LUMIERE. acoustical instrument. APPLICATION FILED JUNE $30,1909$.
986,477.
Patented Mar. 14, 1911.
5 BHeets-sieet 4.

Fig. 9.


Louis Luinviente
witnesses
TF:C. Faituraw.
ar

L. LUMIERE.
aCOUSTICAL INSTROMENT.


WITNESSES

## TH. Hawtimaw.

# UNITED STATES PATENT OFFICE. 

## LOUIS LUMIERE, OF LYON, FRANCE.

## ACOUSTICAL INSTRUMENT.

986,4\%\%
Specification of Letters Patent. Patented Mar. 14, 1911. Application filed June 30, 1909. Serial No. 505,149.

To all whom it may concern:
Be it known that I, Louis Lumere, a citizen of the Republic of France, residing at Lyon, in the Republic of France, have in-
5 rented certain new and useful Improvements in Acoustical Instruments, of which the following is a full, clear, and complete disclosure.

This invention relates to improvements in 10 aconstical instrmments, such as telephones, microphones, sonnd recording and reproducing machines, and musical instruments in general. Is applied to sonnd recording and reproducing apparatus, it relates more which is rencrally known as the diaphragm, or the body which in the process of somed recording is thrown into vibration by the sonnd waves, and whose ribrations are
20 traced and recorded by means of a stylns in the original recorl, while in the process of reprothetion the diaphragm, (as a general pule, the diaphragm of a separate machine), is thrown into corresponding ribuations by
25 a stylus to which it is attarhed being made to follow the undnlations in the record.

The invention also relates to the somel bos in which said diaphagen is momented.
'The object of my invention is to prowide means of which somels may be faithfully recorked and reprodnced, which will be sensilive to somed waves and by the use of which the reprotlaction of somed will le improved 35 alld amplifiod.

Further objects of my invention are to inincrease the reprotheing stuface of a diaphangut, and, at the same time, to place the
 :tolde a diaphagum haviner a plarality ol
 jere "and of a pharality ol sombl momensime
 the semsitiveness throond mad to rathe them (1) vibuate as a whole. (omional), (o make it sensitive; to inerease the active surface of : a diaphragron of a "erdain given diameter; to incerase the diamatce of the diaphagen withont making it liable to vilnate in parts, of to set up nombers ar inative portions in the diaphagun, ore in other worls, formbatamially incwase the size of the diapheagin and, at the same time have it vibate Themphont; to con-

Further objects of $m y$ invention will be found in the specification and claims below.

The invention consists in a diaphragm for acoustical instruments, having one or more freely resilient. sound responsive sur- 6 faces or elements. Which have been brought into a condition of molecnlar stress, of an aggregate superficial area substantially larger than the surface of a plane disk of the same diameter, and in a recorder or 65 reproducer in which said diaphragm is mounterl.

It is found that the effect of bringing the surfaces of a vibrating body into a condition of molecnlar stress by torsion, is to rednce 7 to a minimm the tendency of the ribuating body to form nofles bring operation. so that the surface or surfaces of the diaphagem will vibrate as a whole and will not prodnce the disagreeable eflect which is 7 technically known as basting or shattering.

One constrnction of diaphragm made according to this invention and the method of making it is illustrated in the accompanying drawings. in which:-

Figure 1 shows a folded strip of material from whicll the improved diaphragon mery be made: Fig. 2 is a plan riew of a montifica? form of folded strip of material liom which a diaphragom may be made: lige $\boldsymbol{\theta}$ is a plam view of the diaphoagu: Vig. tis a sectional clevation ol the diaphragm: Fife. 5 is a sexfional clevational view of a slighty montificel
 ilhastrate the way in which the sulderes old ckemente of the diaphragm are twisterl: Fier. 7 is an elevation of a sommel repmodaciner mandine filled with the diaphosagm mater in acoordanme with this imention amd illse
 diaphragm amb comberting it for the sthlas
 \%. Fiin. \& is a platl vion of the manhimo

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 ducロッ slown in Fig. !!.

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which the whole surface of the diaphragm on either side consists of a plurality of elements reversely flexed to form a fan-like series of radially disposed ridges and furrows, the ridges on one side of the diaphragm corresponding to the furrows on the other side of the diaphragm, and the furrows gradually widening out and becoming less deep as they approach the edge of the
10 diaphragm until at its perimeter the diaphragm lies in one plane. The elements forming the sides of the ridges and furrows provide the desired freely resilient sound responsive surfaces. A diaphragm of this 15 form may be obtained by folding or plaiting a substantially rectangular strip of paper 1 , or other suitable material in the manner shown in Fig. 1. The length of the strip of material before folding should be sub-
20 stantially the length of the circumference of the diaphragm to be formed therefrom. and the width of the strip should be substantially equal to the radius of the said diaphragm. When the strip has been plaited or folded
25 in the manner above described and shown, the ends 2 and 3 should be brought together and secured to each other in any suitable manner. At this stage of the process or method, the strip will present, roughly speaking. the appearance of a cylinder having fluted sides. This strip of material is then pressed down and forced to assume the form shown in Figs. 3 and 4, one edge of the strip being crimped together at the center, the radial ridges and furrows. or plaits being closest together and of greatest depth at the center, and gradually opening out and flattening toward the edge where the diaphragm may be held in one plane between clamping rings. as shown in Figs. 7 to 11. In Fig. 3 the diaphragm is designated as 4 and the elements forming the plaits or ridges and furrows are designated by the numeral 5 . The diaphragm 4 thus formed in the manner above described will be seen to have a surface formed wholly of a multiplicity of flexed sound responsive elements. reversely sloped or angled to each other.
50 forming dihedral ridges. The surface of the diaphragm will consist of a surface comprising salient radial angled surfaces, and radial reëntrant angled surfaces. Any sector of the surface will have a fan-like for-

To the center of the diaphragm, is attached, in any suitable manner. the recording or reproducing stylus 6. as the case may be. As shown in Fig. 4. the diaphragm is
60 for use with or for a record having an up and down, or rertical cut, since the diaphragin is directly provided with a stylus at its center.

For making the attachment between the 65 stylus and diaphragm, or between the con-
nection between the stylus and the diaphragm, I prefer to bevel off the inner edge of the diaphragm as particularly shorrn in Figs. 2, 9 and 10. The stylus 6 may be secured directly to the inner edges of the elements of the diaphragm by being cemented or glued thereto in the manner shown in Fig. 4, or it may be secured in place by means of nuts $T$, as will be more particularly described below, in comnection with the form of apparatus shomn in Figs. 9 and 10 and also as shomn in Fig. 5. The stylus 6 may also be surrounded by rings of stiff paper 8 , secured on either side of the diaphragm at the center thereof to give it additional rigidity at that point. I do not, however, limit myself to this form of connection. The effect of constructing the diaphragm in this manner. is that the whole diaphragm. i. e., the surface of each element of each ridge and furrow is under molecular stress, procluced by torsion. but the sides of the ridges and furrows are twisted out of the plane in which ther lie at the center of the diaphragm into a plane, practically at right angles thereto at the circumference of the diaphragm. I have further found that in a diaphragm produced by this means, the tendency of the ribrating body to form nodes during operation is reduced to a minimum. The surface of each of the elements composing this diaphragm being helicoidal, and since each point in the vibrating body. as it mores, follows a direction normal to the tangential plane at this point. the result is that the direction of morement is different for each point that has to be considered so that the formation of nodes is practically impossible. It is obrious. of course that the' same condition of molecular stress would be produced mpon tristing a sheet of material which naturally possessed a helicoidal or other than plane form so as to take up a position in a true plane. or other helicoidal form of different pitch.

The diagram shown in Fig. 6. illustrates clearly the torsion which is applied to each of the multiple surfaces or elements of the diaphragm when the strip of material is made to take up the form shornn in Figs. 3 and 4 from the form shown in Fig. 1. In this diagram $5^{\prime}$ represents a thin flat sheet of elastic material. such as is formed by each of the several folds or plaitings of the strip shown in Figs. 1 and 2. If the tro ends of this sheet are turned in opposite directions, as indicated by the arrows. and are made to take up the position shown in dotted lines. it is found that a very resilient borly is formed, which is capable of vibrating more readily, and is more sensitive, i. e., more sonnd responsive in its new position than it was before. This is probably due to the molecular stress which is imparted to it by this twisting action. It will be clear that each of the
surfaces or folds 5, of the diaphragm illustrated in Figs. 3 and 4 is in the same condition of molecular stress, as the sheet $5^{\prime}$ in Fig. 6.

The width of the folds 5 , relative to the breadth of the strip in which they are made, may vary; but I have found a convenient proportion to adopt when making the diaphragm of paper is about 10 to 1 , so that 10 each fold of the strip is 10 times as long as wide.

I have found that in a diaphragm having multiple resilient surfaces such as that above described, a greatly improved reproduction
15 can be obtained. Moreover, a diaphragnı constructed in the manner above described can be usefully made of considerably greater diameter than has heretofore been possible. Experience has seemed to prove 20 that a plane diaphragm of mica, or other material, such as is used at the present day, if made of more than about three-and-ahalf inches in diameter, loses in quality of reproduction, the reproduction becoming less
25 musical and there being a liability to what there is technically known as "shattering ", due probably to the diaphragn not vibrating as a whole, $i$. e., to the setting up of nodes in the cliaphragm. I have found, 30 however, that I am able to make a diaphragm according to the present invention, as large as ten inches or more in diameter, without impairing the quality of the reproduction, and by means of this diaphagm, 1 at the same lime, attain a minch greater colume of sound than with the smaller diaphragm. 'This amplification of the somod, I believe to bedue not ouly to the increased diameter of the diaphragn, but also to the 40 increased surface area of the diaphragm produced in the eonstruction above described, by the platings or rimpings or folds in the material of the diaphagm; this appears to have the effect of putting into creasing the volnme of sombl.

I diaphragm having freely resilient sombd responsiae surfaces bomght into a condition of molechlar stress, preferably by forsion, and
 than a phane disk of the same diametrer mase of comse be produred in other ways than that above deseriber. I hate fommed, lownever, that the alone deseribed method is : eonvenient one for making the diaphation.

The advantage arising trom the nse of a diapha:g gin conshmoded as abowe dexeribay. is that the volume al somed prodteren is sulficient to amble me to dispernse with lla
f0 nsinal anplifying hom, mont in this way, mumb of the metallice and hollow edanadere usially assumated with talking marhimerer produrdions is climinaterd.

Diaphagros may be made areordine to 65 this inventioni, of any sutable clastic ma-
terial, such as paper, (which may be rarnished if desired), card, celluloid, metal, or the like, and the surface, or surfaces, of the diaphragm, or elements composing the ribrating body, may be put under tension by any suitable means.

One means of mounting the stylus bar and diaphragm in an operative position particularly for use with a record having a record of sound in the form of a groove haring lateral undulations in the walls thereof is shown in Figs. 7 and 8. In this case, the diaphragm 4 is held at the edges by clamping rings 9 and 10 , and, to the front ring ? may be secured a sinall trumpet 11 for directing the sound waves. The clamping ring 10 is fixed to a suitable backing ring 12, having radial arms 13 by which the same is carried by a tube 14 which is capable of turning freely in the bearings $1: 5-1.5$, of the swinging arm 16 , piroted at 17 upon a rigid bracket 18, fixed to the cabinet 19 . The cabinet 19 is provided with a suitable mechanism for rotating the turn-table en upon which a record 21 is carried in the 90 usinal manner.

The tube 14 is provided at one end with a mounting 22 freely rotatable upon said tube 14, but prevented in any suitable manner, from longitudinal movement npon the tube 14 . This mounting 22 rarries a stylns bar 23 which may be mounted thereon in any snitable manner, as by being piroted on the knife edges 24 and retained on salid knife edge bearings by a spring 2\% in the usinal manner. The nipper end of the stylus har 23 is connected hy a rod 26 with the dianphagm 5, the rod $2 f$ being connerter or attached to the diaphragm by mits 7 in the manner shown in Fig. 5. In this comstmotion as slown in Figs. 7 and s. the diaphragm is preferably marle from : whed al material such as is shown in Fig. OU of the drawings so as to provide al sultable peress on eatch side of the diaphragm. in which the muts 7 are semted. These mint may be fal How eemented on otherwisesecherd totherdial phagen. In the satid figures the diaphragur is also shown as beong provided with a stitl(ming vings an the center of the diaphatign and simpomding the stym hat combertion 2f. Suitable mut or collans maty be com
 wise movernent in the hearing $\mathrm{i}=$

As the stylus es follows the reated aromed 120

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 tion of the recomal. I sulatabla medight en may be wltarhed to tha monnting ..... (o)
 the reqninite amment of promber


my diaphragm mar be used in connection with a sound reproducing machine. In said figures. the record 21 is supported upon and rotated by a turn-table 20 driven by any j suitable motor within the casing 19, and the cabinet is provided with a bracket 18 similar to the arrangement above described in connection with Figs. $\bar{T}$ and 8 . An arm 30 is mounted upon a steam or pintle 31 to 10 swing on said bracket in a plane substaitially parallel with the plane of the record 21. The bracket 18 may be provided with a vertically adjustable step $3: 2$ for the enci of the stem 31 . which, in the form illustrated
${ }_{15}$ in Fig. 9. consists of a screw threaded into the bracket 18. and against which the end. of the stem or pintle 31 rests. By this means, the arm 30 mat be raised or lowered to adjust the parts carried thereby with re-
20 -pect to the record 21 on the turn-table 20 , to set the strlus at the proper angle to the record surface. The free end of the arm 30 carries a yoke 33 pivoted to the said arm by a bolt or pin 3t, so as to be capable of
25 swinging in a plane substantially perpendicular to the plane of the record. The said arm 30 is provided with a stop 35. Which prevents the yoke from swinging downwardly beyond a predetermined point. The
30 onter ends of the yoke 33 are secured to lugs 36 bolted to the rings $3 \bar{T}$, 38 . br bolts 39, passing through said rings and said lug. Screms 40, passing through thie ends of the yoke 33 and into the lugs 36 . form the
35 pirots to permit the rings and the parts carried thereby. to oscillate thereon. The diaphragin $41^{\prime}$ is of the kind which I have describell above: that is to say the diaphragm is formed br retersely folding a sheet of
40 material to form plaits. each plait forming an element of the diaphragm. and each of these plaits or elements is subjected to a torsional tension or strain by the bringing of the folded or plaited sheet of material
45 into a substantially circular form. In theere Fige 9 to 11. the diaphragn is shown practically as being formed from a sheet of material such as is shomn in Fig. 2: that is to say: a strip in which each plait is cut away
50 at its immer corners so as to form a recess on each side of the center of the diaphragm to permit of a convenient attachment of the stylut har to the diaphragm. Is is plainly shown in Fig. 10, the diaphragm
$55+1$ i- clamped between the ring-, 37 and 38 . and securely held in that position loy means of the screcirs 42 pascing through the said rings and drawing them together. I prefer. howiverer. to interpose. betwicen the ringes 37 60 and 38. and the diaphragm. thin rings 4.3-13 of a suitable nen-metallic and prefcrably -lightly clastic material. one on each cide if the diaphragm. Theere rings ti3, mar be of fabric. or rulber. or filer. or any other 65 suitable material to prevent an actual con-
tact between the diaphragm and the metallic rings 37 and 38 , and to securely hold the periphery of the diaphragm in a single plane. í suitable small trumpet 11 may be also secured between the rings for the purpose of directing the sound wares. I have shown it plainly in Figs. 9 and 10 as composed of a slightly flaring substantially conical member having a flange $11^{\prime}$ clamped between the rings 37 and 38 . the screms 42 passing therethrough. The periphery of the diaphragm 41 is clamped between the intermediate rings 43. and held thereby in a single plane as plainly shown in Fig. 10.
The botton of the reproducer is prorided with a suitable support for the stylus bar, said support comprising a bar 4 seecured to the ring 38 by screws 45 . or in any other suitable mamner. The said bar $4+$ may carry a block 46 rigidly secured thereto and upon the lower side of said block. I momnt the stylus bar. Any suitable mounting for the stylus bar may be employed. but in the said modification illustrated in Figs. 9 to 11. I have shown the block to an provided with a 90 pair of alined knife edges $\tau_{7}$ engaging suitable recesses and lateral extensions 48 of the strlus bar 49. Each lateral extension is provided with a apring so. one end of which is attached to said extension ts, and the other end of which extends ontwardir and is provided with a hole through which a screm 51 passes. the head of the scret engaging the end of said spring so and the screw being theaded in a snitable tapped plate 5.2 carried by the said block 46 . In this way the styllis bar is yieldingly held upon the knife edges $+\bar{T}$. but is free to oscillate upon them as bearings. The lower end of the stylus bar is prorided with a suitable set screiw 33 for securing the strlus $5 \pm$ in the socket therein. The stylus bar 49 may have a portion $49^{\prime}$ extendiigg at an angle to the strlus carrying portion and it mary then extend upwardly as at is to this point of attachment to the center of the diaphragm. I have shown the said uprardly extending portion 5 as as being curved in order to make it slightly yielding, and the point betreen the portions 49 and 5.5 as being materially weakened to enable the strluc bar to readily bend or spring or give slightly at this point to tran-form the ribratory movement of the stylus: into a reciprocatory movement of the portion 55 which is directly attached to and consequently communicates its motion to the center of the diaphragm.
In arljusting the reproducer to the recorded surface. the arm :30 should be set at orch :" height that the -tylu; will be given a slight rake to the recorded surface, as plainly thown in Fig. 9. This will permit the record to slide ficely beneath the stylus without unduly scratching the same and cause the stylus to engage the record with 130
a sufficient pressure to insure the tracking of the stylus in the record groove. The record may then slide freely beneath the stylus, and the whole reproducer may swing
5 slightly on the bolis or pins 40 to allow for any irregularity or unevenness or warp in the recorded surface.

In order that the stylus may not bear too heavily upon the record, the trumpet 11
10 may be provided with a suitable counter-balance-weight 59.

From the preceding description it will be plain that the whole construction is such that the trunpet, diaphragm, rings and hus attached thereto may be swing upwarcly about the bolts or pin 34 as a pivot for the purpose of replacing the stylus or for throwing the whole device into an inoperative position, as indicated in dotted lines in Fig. 9.
In operation it will be apparent that when the record is given a rotary movement from the turn-tabie 20 and the stylus 54 engages the record 21, the whole reproducer will
25 swing about the stem or pintle 31 as a pivot allowing the needle or stylus 54 to track across the record and the stylus will be cansed to assmme the correct angle to the recorded surface by the adjustment of the
30 step 32 against which the stem or pintle 31 alments, and further, that the styhus will be prevented from bearing too heavily upon the record by the comer-weight 39 attached to the upper end of the trmmpet 11 .

In all the forms which I have above deseribed, it will be seen that the diaphragm is constructed upon the same principle, and that it is momed in substantially the same manner, and that any suitable manner of securing
40 the stylus to the center of the diaphragni may be employed, and while I have shown a small fommpet 11 in commection with the constructions which I have illustrated, it is to bee muderstood that the frumpet may
45 be entirely dispensed with if desired, the function befner to mive direction to the sombl waves rather than to increase the volmme of the sommed reprodued by the diaphragur.
50 Having thus describedmy invention, what I clam and desire to proted by Letters Patent of the United States, is:-

1. The method of making a diaphoagm which consists in plating a strip of sulit-
55 ablematerial, joining the cuds of the plated matcrial and bringing the same (o) a circular
shape to form a diaphragm in which each of the plaits forms an element subjected to torsional tension.
2. The method of making a diaphragm 60 which consists in plaiting a strip of flexible material, joining the ends of the plaited material and subjecting each of the plaits to a torsional tension.
3. The method of making a diaphragm 65 which consists in reversely folding a strip of flexible material into a series of plaits, removing a corner of each of said strips, bringing the ents of said plaited material together and forming the same into a substantially circular shape having radial salient and reëntrant angles.
4. The method of making a diaphragm which consists in reversely folding a strip of flexible material, twisting the folded 7 sheet into substantially circular shape and rigidly holding the edges of the diaphragm so formed in a single plane.
5. The method of forming a diaphragm, which consists in plating a substantially so rectangular strip of material, removing a corner of each plait on one side of the strip, uniting the ends of the strip and forming the said material into a substantially circular diaphagn, cach of the plaits form- 55 ing an clement of the diaphragm with its edge at the center of the diaphragm substantially parallel to the axis of the diaphragm and the edge of each plait at the periphery of the diaphragur being brought 90 to substantially a single plane.
(6. The method of forming a diaphragm, Which comsists in plating : : mblatatially rectangular strip of material, miting the (ends of the strip) and forming (he said ma- 95 terial into a substantially circular diaphation, carth of the phats forming an clement of the diaphragm with its colge at
 parallep to thic axis of the diaphagan, the 100 colge of each plat at the periphery of the diapluagm being homght (o submantially a single phanc, and serenting :1n ammati strip) of villeming (o) the andera of the ale ments aljacent the center of the diaphagem. 105

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Winnesces:

1. N. Ramme,
A. J. (401.:~)

Copies of this patent may be obtained for five cents enoh, by adiressing the "Commissioner of patents.
W. S. COBB.

SOUND DISTRIBUTING HORN.
APPLIOATION FILED APB. 12, 1910.
986,908.
Patented Mar. 14, 1911.


Inventor
WII. S. cobb.

Qitmesses
Thos Ft knox.
OUW. Euld

# NITED STATES PATENT OFFICE. 

## WILLIAMI S. COBB, OF FLUSHING, NEW YORK.

SOUND-DISTRIBUTING HORN.
$\mathbf{9 8 6}, \mathbf{0 0 8}$.
Specification of Letters Patent. Patented Mar. 14. 1911.
Application filed April 12, 1910. Serial No. 555,027.

## To all whom it may concern:

Be it known that I. Whimian S. Cobs, a citizen of the United States, residing at Flusling, in the county of Queens aurl State 5 of New York, have invented new and useful Improvements in Sound-Distributing Horns, of which the following is a specification.

The invention relates to an improvement in sound regulators, being more particularly
in directerl to the construction of a somed intensifying horn whereby such sonnd is rendered more distinctive and the tone thereof materially improved.
The main object of the present invention
15 is the provision of a sound regulator formed in provide a plurality of interior sonnd passages through which the somd waves are arranged to travel in succession, the constraction and control of such passages providing
20 for the rapid and uniform expansion of the sound volume in traveling from one passige to the next whereby to intensify and improve the tone of such sound.
The invention in its preferred details of 25 construction will be described in the following specification, reference being had particularly to the accompanying drawings, in which:-
Figure 1 is a view in clevation, pattly in 30 section, of the improved horn. Fig. 2 is a similar view broken away, showing a slightly different construction.

Referring particularly to Fig. 1 of the accompanying drawing, the improver horil
35 may be satid to comprise a tube or body ser-tion 1 and a month section 2 . Whid sections are removally comected at 3 in any appropriate or prefered manore, wherely they miny be assembled in hon-n-moning celation
40 or discomecteri for close parking in storage or (ramsperation. Arranged within the month section and commmicating with the somml indet opening I therethromg is an inner somed tube or, whicls tubare extemse within
45 the montlo section of the hom :11 :1pmos priate distanee is of gradnally ineremsed diameder from the inlet for the mifled emb amb is open at the immer amb. Shemed willing The month cedtung and rimideling the lata
50 th is what I term all oulcor tube fis. This tuln is preferally of miform diancon thomen ont its lemgits and seromed son that it in tis posied in spaced relation Homongen its

55 chamber 7 is arrangel betwern the inhes. Py reasom of the gradmaly invomsing dian-
eter of the tube :) from the inlet to the outlet, and the uniform diameter of the tube (i, it will be noted that the chamber 7 giradually: increases in area from the end thereof adjaicent the free ends of the tules .5 and (i) toward the end adjacent the comnected ends of said tubes 5 and (6. In other words, the space within the tube 5 gradually increases toward the outlet end of said tube while the 6 space within the chamber ? gradually inreases in area in the opposite dircetion.

The tube 6 is preferably closed at the forward or free end, as at 8 , and formed adjacent the opposite end with a series of openings 9. These openings may be of any contour or size being preferably, however, arranged in a concentric row. The openings ? serve to establish conmmication between the chamber 7 and the horn proper, or that space surrounding the tube of within the month section of the horn. To provide for regulating these openings and thereby gorerning the volume of somb passing thercthrough, I arrange what I term a ralve 10 including an anmular strip slidably mounted on the ouler surface of the lube is and operated throngh the medium of : finger lever 11 projecting from ann opening 12 formed in the mouth section. By proper manipmation of the finger lever, the slide valve 10 may be arranged to vary the size of the openings ? in acenrlance with the volume of somed desired, as will he ctemery obvions from the drawings.

In Fig. 2. The constrintion is indatical with that just deseribed excep that the tulx ( i is provided with a removahle eap 1:3. which (ap, in addition to its removabilit! amb by reason of :131 extomed adece thange 11 , is tapable of adjustment lomgitudinally un the tube (asen as for dispuse flac lramswara wall of
 10) the fred ende of the lubu 5 , whemer ther
 f11) 1 maty be variad in si\%a (10 control the rollune of smmal passing from the fulae is




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with the usual horn structure by reason of spreading waves at the end of the inner tube and again at the end of the outer tube. In this result the adjustability of the cap 13 to vary the size of the chamber at the end of the inner tube provides for regulating the increase in volume at this point, as desired. Again, the inner tube diverges toward its outlet providing for the gradual spreading of the sound waves, which gradual spreading is also maintained in the chamber 7 . Furthermore, the adjustability of the valve 10 controlling the outlet from the chamber 7 to the horn proper provides a further means for manually regulating the volume of sound.

It is of course to be understood that while the improved horn is designed primarily for use with reproducing machines, as gramophones and the like, it is to be understood that its use is contemplated with any and all devices in which sound volume is to be increased, such as megaphones, horns of any type and the like.

Having thus described the invention, what I claim as new, is:-

1. A horn, an inner tube arranged therein, an outer tube encircling the inner tube and communicating therewith, means for vary-
ing the space at the point of communication, 30 and means for adjustably controlling the communication between the outer tube and the horn proper.
2. A horn, an inner tube arranged therein, an outer tube encircling the inner tube 35 and communicating therewith, and means for varying the space at the point of communication, said outer tube being formed with openings establishing communication between the same and the horn proper and manually operable means for varying the size of the openings.
3. A horn, an inner tube arranged therein, an outer tube encircling the inner tube and communicating therewith, means for 45 varying the space at the point of communication, said outer tube being formed with openings to establish communication between said tube and the horn proper, and a manually operable valve for simulta- 50 neously controlling the size of said opening.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM S. COBB.
Witnesses:
Lester S. Parmenter, John J. Klein.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

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987,205
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J. A. WILLIAMS.
sODND BOX. APPLIOATION FILED JUNE 18, 1904.
987,205.


## UNITED STATES PATENT OFFICE.

JOHN A. WILLIAMS, OF BROOKLYN, NEW YORK, ASSIGNOR TO HENRY C. MILLER, OF WATERFORD, NEW YORK.

SOUND-BOX.
987,205.
Specification of Letters Patent. Patented Mar. 21, 1911. Application filed June 18, 1904. Serial No. 213,175.

To all whom it may concern:
Be it known that I, Joinn A. Williams, a citizen of the United States, residing at Brooklyn, in the county of Kings and State
5 of New York, have invented certain new and useful Improvements in Sound-Boxes, of which the following is a specification.

My present invention pertains to improvements in sound-boxes. the construction and 10 advantages of which will be hereinafter set forth, reference being had to the annexed drawings, wherein:

Figure 1 is a longitudinal sectional view, on the line 1-1 of Fig. 2; Fig. 2 a front
15 face view, the compression-ring or plate being partially broken away; Fig. 3 a perspective view of the varions parts of the box, with the exception of the stylus-bar or arm; Fig. 4 a vertical sectional view of the com-
20 bined indicating and locking device for the adjusting-screw; Fig. 万 a perspective view of the stylus-har or arm ; Fig. 6 a sectional view on a somewhat enlarged scale, showing a slight modification of the mounting of the
25 diaphragm; and Fig. 7 a perspective view of a modification of the means employed clamping the diaphragm.

The primary object of my invention is to obtain a somed-box which may be readily as-
30 sembled and adjusted by a person having but slight mechanical skill, the box then giving as good results as if assembled by an expert in such work.

A further olject is to provide means 35 whereby the pressure on the edge of the diaphangm may be varied, and the condition of the diaphagm so changed thereby that it will accommodate itself to the class of work being mudertakem. In other words, the box
40) has a wide on miversal range, repooducing high and low motes. "hlast" notes, and the tones of varions instrmments, or combinations of instrmomes with apmal facility, and the tomes produced becing perfectly trow at all
45 times. Tho adjustment of the diaphragin also permits it to be regulated in aceordance with the aconstice properties of the room on space in which thr instrmment is being comployed.
A still furthere ohjed of the invention is (0) provide menns wherehy the adjusting. serew (which is employid to vary tha
nmount of compression on the ring or plate) may be locked in position, and the degree of compression indicated by a combined scale and pointer.

In the construction shown in Figs. 1, 2 and $3, A$ denotes the shell or casing, having a sleeve B for attacliment to the instrument, as usual. Within the lower portion of the shell, adjacent to the upstanding wall or rim C thereof, is formed a groore or channel D, a washer or gasket E, preferably of highgrade rubber: overlying said groove and bearing at its inner edge upon the bottom of the shell. A diaphragn F of mica, glass or other suitable material rests upon the gasket E, and a second packing-ring or gasket ( i is placed upon the diaphragin. it compres-sion-ring or plate H overlies the parts thus assembled, said ring or plate (as shown in Figs. 1. 2, 3 and 6) being providerl or formed with integral cross-bars I, which cmeve slightly upward from said ring. An adjust-ing-screw ot is momed in a supporting-bar K. seemed to the shell or casing, the lower end of said serew being slightly romuded and hearing upon the cross-bars at their point of jumetion.

Is will be readily apmeriated, the degree su of compression mon the diaphagem may he rapied as desimed, and the proseme exerted will be miform her reanm of the fant that fores is applad th the ring of emploresionplate at one point only, namely, the cemter

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into groove or chammel I) to a greater or less degree, thereby tending to stretch the diaphragm and arch it to a slight extent, causing it to become extremely resilient and ca5 pable of producing a sharper or thinner quality of tone. The tension thus caused has no tendency to wrinkle, furrow or distort the diaphragm, which is especially apt to occur in case a mica diaphragm having
10 slight undulations in its surface is used.
In order to ascertain the degree of compression exerted by the screw and to hold the same in its adjusted position, the upper face of the head of the screw is provided
15 with a series of radial notches or recesses S , graduated as shown in Fig. 2. A barrel or tubular member $\mathrm{S}^{\prime}$ is mounted in the bar K , the opening in the lower portion of the barrel being larger than that in its upper por-
20 tion, thus forming a shoulder $\mathrm{S}^{2}$. A rod or plunger $S^{3}$ is mounted in the tubular member $S^{\prime}$, and a spring $S^{4}$ surrounds said plunger, bearing against the head thereof at its lower end and against the shoulder $S^{2}$ at its
25 upper end, thereby tending to draw the plunger downwardly in the tubular member. Said plunger is provided at or near its upper end with a cross-pin $S^{5}$, which works in slots formed in the head of the tubular mem-
$\therefore 3$ ber $S^{\prime}$, the outer end of the cross-pin $S^{5}$ overlying the head of the adjusting-screw $J$ and entering the notches $S$ formed therein as the adjusting-screw is rotated and its notches are brought into alinement with the cross-
35 pin. It will thus be seen that the spring tends to hold the cross-pin in engagement with the adjusting-screw, and consequently locks said screw against accidental rotation, thereby preventing any change in the de40 gree of compression exerted upon the diaphragm except when the screw is manually operated. The cross-pin therefore serves the double function of an indicator and a locking device.

In Fig. 6 a modification of the invention is shown, wherein the presser-plate or ring $\mathrm{H}^{\prime}$ is formed with a circumferential groove or recess $\mathrm{II}^{2}$, which provides a space for the expansion of gasket $\mathrm{C}^{\prime}$, overlying the dia-
50 phragm. With this arrangement the diaphragm may be put under stress or tension without being arched. The adjustment of the ring or presser-plate permits the adjustment of the device to compensate for de-presser-plate be provided with a por the $\mathrm{H}^{2}$ ( Fi ( G ) or be of II. Figs. 1, 2 and 3.

The stylus-har $I_{1}$ is connected at its inmer 60 end to the diaphragm. to one side of the center thereof, see Figs. 1 and 2, by any suitable athesive, the outer end of the bar being soldered, sweated or riveted in a groove or sa w-cut formed in a post or stud M, extending upwardly from a head or block N. A
thin web or plate $O$, permanently secured to the head N , or formed as an integral part thereof, extends outwardly therefrom in line with bar L, entering a sar-cut formed in the side wall $C$, and being secured in place 70 by screws $\mathrm{P}^{\prime}$.

Any material possessing sufficient tenacity or strength may be employed in constructing the web or plate. Copper, of $5 / 1000$ of an inch in thickness has thus far given the best 75 results.

As will be seen upon reference to Fig. 1, the web stands in approximate alinement with the diaphragm, and by reason of this fact and the further fact that the head N lies close to wall C of the frame, no endwise movement of the stylus-bar can take place. It simply rocks upon a line which extends through the web, and as the latter is preferably formed of a material possessing but slight resiliency there is in effect practically no resistance to the rocking of the stylus-bar when moving in consonance with the diaphragm. As will be seen, there are no loose parts; no parts to be adjusted, and, as a consequence, no parts which can produce a rattling noise.

The head N carries the usual needle or stylus $P$. The inner end of the stylus-bar just clears the diaphragm when the parts are assembled, and previous to its being secured to the diapliragm,-consequently there is no tendency of the bar to buckle the diaphragin. as is the case in the usual construction, in which a screw passing through the diaphragm enters the end of the stylus-bar.

As previously noted, the stylus-bar is connected to the diaphragm to one side of the center thereof, or more nearly adjacent to that side of the frame to which the web $O$ is secured. The point of attachment is, therefore, approximately coincident with the center of a line extending from the rockingpoint of the bar to the diametrically opposite side or edge of the diaphragm, thus insuring the greatest possible range of movement.

In Fig. 7 a slight modification of the inrention is illustrated. Instead of making the presser-plate or ring and the cross-bar's integral, they are separately formed, the ling being designated by the letter $Q$ and the spider or intermediate frame by $R$.

With a compression ring or plate constructed as shown in Figs. 1, 2 and 3, that is to saly, formed of relatively light metal, struck up in a die, there is a tendency for the ring to respond slightly to the vibrations of the diaphragn, though not to a sufficient degree to prove detrimental in practice. The rigidity of the structure, however, is such as to permit the required degree of compression to be applied to the diaphragm.

As hereinbefore stated, the several parts of the box may be readily assembled and
adjusted, and further the compression on the diaphragm is equal throughout the entire extent of the plate or ring.

Having thus described my invention, what 5 I claim is:

1. In a sound-box, the combination of a frame; a diaphragm mounted therein; a stylus connected to the diaphragm; a com-pression-plate adjacent to the edge or pe-
10 riphery of the diaphragm; and means for applying pressure centrally to said compres-sion-plate, whereby the pressure upon the diaphragm may be varied as desired but maintained even throughout the entire bear-
15 ing surface of the diaphragm, substantially as described.
2. In a sound-box, the combination of a frame; a diaphragm mounted therein; a stylus connected to the diaphragm; a com-
20 pression-plate adjacent the diaphragm; and means for applying pressure to said plate and permitting it to rock or tilt with reference to said means, whereby the pressure may be varied as desired but will be even
25 throughout the entire bearing surface of the plate, substantially as described.
3. In a sound-box, the combination of a frame having a groove or channel formed therein; a packing-ring overlying said
30 groove or channel; a diaphragin; a second packing-ring mounted upon the diaphragm; a presser-plate or ring having a groove or recess formed adjacent to its periphery, said plate overlying the second packing-ring; and
35 means for applying pressure to said plate or ring.
4. In a sound-box, the combination of a frame; a gasket or packing-ring mounted therein; a diaphragns momted upon said packing-ring; a second packing-ring resting upon the diaphragin; a compression-plate or ring mounted mpon said packing-ring, said plate being provided with eross-hars or mentbers I; a supporting-har secured to the
45 frame and extending over the compressionplate; and an adjusting-serew carried by said har and bearing at its lower end upon the cross-bars of the compression-plate.
5. In a somd-box, the combination of a

50 frame; a diaphragm momed therein, said diaphragm being tree to expand circumfercintially; and means tending to stretch said diaphragm, sulbstantially as described.
(f. In a sound-lox, the combination of a

55 frame; a diaphragni mounted therein and free from direat comection therewith; and means for applying pressure to mad expanding the diaphragm (ciremenferentially, sub) stantially as desceribed.
7. A somd box comprising a casing having an ammlar flange, 11 sulstuntially that diaphragm within the casinge, " Hange on which the dimphengm is sented, and means acting on an mmand line within the murgin of the memalar flume on the casing to dish
said diaphragm in concavo-convex form throughout its entire area to alter the pitch of the latter.
8. In a sound-box, the combination of a suitable frame; a diaphragm mounted therein; a stylus-bar comnected said diaphragm; and a web connecting said bar directly to the frame, the web lying in substantially the same plane as the diaphragm.
9. A sound box comprising a diaphragm, a washer on which the diaphragm is seated, a washer acting on an annular line on the opposite side of the diaphragm to dish the latter in concavo-convex form throughout its entire area, and means operating the latter washer.
10. In a sound-box, the combination of a suitable frame; a diaphragm mounted therein; a stylus-bar connected to said diaphragm at a single point to one side of the center of the diaphragm; and a rocking connection between said stylus-bar and frame.
11. In a sound-box, the combination of a suitable frame; a diaphragm mounted therein; a stylus-bar; a connection between said stylus-bar and the frame; and a single connection between the stylus-bar and diaphragm substantially midway between the connection of the bar to the frame and the diametrically opposite side of the diaphragm, substantially as and for the purpose described.
12. In a sound-box, the combination of a suitable frame; a diaphragm monnted therein; a compression-plate; means for actuating said compression-plate; and means for determining the degree of compression, substantially as described.
13. In a sound-box, the combination of a suitable frame; a diaphragm monnted therein; a compression-plate; a screw for adjusting said plate; and a scale working in conjunction with said screw.
14. In a somd-box, the combination of a suitable frame: a diaphragm; means for varging the state of tension of salid dianphragm; and means for determining said tension.
1.. In a sombl-hox, the combination of a smitable liame; a diaphagm: means for varying the state of fonsion of said dinphagin: and means for determining the degrer of temsion and lodking the temsion varyine means in pusition.

1ij. In a sombd-hex, the combination of a snituble lianme: a di:phragim momber there in; : comprescion-phate; 11 s.cew for adjat ing said plate: a solle working in conjunc


17. In an summl las. Hae combmation of a Hitalde fame : A diaphragm momatel there
 inger sind plate, the sorew haing powndel

pressed pin working in conjunction with said notches.
18. In a sound-box. the combination of a suitable frame ; a diaphragm mounted there-
5 in; a compression-plate; a screw for adjusting said plate. the screw being provided with a series of notches and graduations in line with said notches: and a spring-pressed pin working in conjunction with said compression and to hold the screw in its adjusted position.
19. In a sound-box, the combination of a suitable frame : a diaphragm mounted there5 in; a compression-plate; a supporting-bar; a screw for adjusting said plate, the screw being provided with a series of notches in its upper face; a tubular member carried by said supporting-bar arljacent to the said tubular member; and a cross-pin carried by the upper end of the phunger, the outer end of said pin lying in the same plane as the notches formed in the screw, sub5 stantially as described.
20. In a somnd-box, the combination of a frame; a diaphragm mounted therein; and a resilient compression ring free at its periphery for holding the diaphragm.
21. In a sound-box, the combination of a frame; a diaphragm mounted therein; a resilient compression-ring for holding said diaphragm, said ring being free at its periphery; and means for adjusting the pres5 sure of said ring.
22. In a sound-box, the combination of a frame; a diaphragm mounted therein; a compression-plate bearing on the diaphragm and free at its onter edge : and means for aping with the pitch-altering means; and means for holding the indicator in adjusterl position. 24 . In a somed box, the combination of a frame formed with an annular groove, a diapluagm, a gasket interposed between the diaphrag and frame. the free edge of the gasket being adjacent the groove, and a regasket bemg adjacent tre groore, and a reand adjacent the edge of the diapliagm to stretch the latter.

2\%. In a sound box, the combination of it frame formed with an annular groove, a diaphragm, a gasket interposed between the diaphragm and frame, the free edge of the gasket being adjacent the groove a resilient compression ring arljacent the free edge of the diaplagm, said ring being free at its periphery, and means for adjusting the pressure of said ring, to stretch the diaphragm. 26. $\Lambda$ sound box comprising a diaphragm, plying pressure centrally to said plate.
23. A sound-box comprising a diaphragm; means for altering the pitch of the diaphragm; an adjustable indicator coöperatmeans for altering the pitch of the dia-
phrasm, and an adjustable indicator cooperating with the pitch altering means.
$\underline{-7}$. In a sound box, the combination of a suitable frame, a diaphragm therein, a compression plate, a screw for adjusting said plate. and a scale working in conjunction with the screw.
28. In a sound box, the combination with a frame, formed with a recess, a thin plate fitting in the recess, a stylus lever supported on the thin plate, and a diaphragm with which the stylus lever coöperates.
29. In a sound box, the combination with a casing formed with a recess at its edge in alinement with the center of the casing, a diaphragm in the casing, a thin plate fitting in the recess, a stylus lever supported on the thin plate at a point beyond the edge of the casing, said stylus lever extending from the support in a radial line with the center of the diaphragm.
30. A sound box comprising a diaphragin, means for altering the pitch of the diaphragm inchuding il frame, the free edge of which is located adjacent the edge of the front of the diaphragm, a support in front of the casing and the frame, and an adjusting device mounted in the front support and bearing on the frame to stretch the diaphragm.
31. In a sound box, the combination with a casing formed at its edge with a radial recess, a diaphragm, a flat thin plate fitting in the recess, a stylus lever supported on the flat thin plate, a stylus carried by the stylus lever at a point below the thin plate.
32. A sound box comprising a cliaphragin, means coöperating with the diaphragm for altering the pitch, and an indicating device attached to the pitch altering means to indicate the degree of pitch of the diaphragm before operating the sound box.
33. A sound box comprising a diaphragm, means cooperating with the diaphragm for altering the pitch, an indicator forming a part of said pitch altering means, and independent means for adjusting said indicator.

34 . A sound box having a diaphragm, resilient washers adjacent the diaphragm, a spider for compressing the washers, and a single screw for adjusting the spider to regulate the pressure of the spider on the washers.
35. A sound box comprising a diaphragm, means for altering the pitch of the diaphragm, an indicator coöperating with the pitch altering means, and means for limiting the movement of the indicator.
36. A sound box comprising a casing, a diaphragm in the casing, a stylus lever cooperating with the diaphragm, and a flat resilient plate extending from the periphery of the casing parallel with the diaphragm, and means for securing the flat resilient plate to the casing and the stylus lever, said
flat resilient plate being unrestrained intermediately of its points of attachment to the casing and stylus bar.
37. A sound box comprising a casing 5 formed with a groove, a flat resilient plate fitting in the groove and extending from the periphery of the casing and disposed wholly within the front and rear planes of the opposite walls thereof, and parallel to said
10 walls, a diaphragm in the casing, and a stylus lever formed with a groove and secured to the diaphragm, the outer end of the flat resilient plate fitting in the groove in the stylus lever, said flat resilient plate being unrestrained
15 intermediately of its points of attachment to the casing and stylus bar.
38. A sound box comprising a casing, a flat resilient plate extending from the periphery of the casing in a direction which is
20 at an angle to the axis of said casing, a diaphragm in the casing, a stylus lever extending from the diaphragm and connected to the casing by the flat resilient plate, said flat resilient plate being unrestrained inter-
25 mediately of its points of attachment to the casing and styhs bar.
39. A sound box, comprising a casing formed with it groove, a flat resilient plate fitting in the groove and extending from the
30 periphery of the casing in a direction at an angle to the axis of said casing, fastening means passing through the casing and the flat resilient plate to hold the latter in position, a diaphragm, and a stylus lever ex-
35 tending from the diaplaragm and overlapping the periphery of the casing, and formed with a groove, the outer end of the flat resilient plate fitting in the latter groove.
4.0. $\Lambda$ sound box comprising a casing, a

40 stylus lever, a stylus, a diaphragm, a flat resilient plate attached to and extending from the periphery of the casing, and atfacherl at its opposite end to the stylus lever, and the diaphragm stylus and resilient plate
45 being in a single plane, said flat resilient
plate being unrestrained intermediately of its points of attachment to the casing and stylus bar.
41. A sound box comprising a casing, a diaphragm, a stylus bar, and a flat resilient 50 plate extending from said casing in a plane at an angle to the periphery of said casing and attached to the casing and the stylus bar it oppositely disposed ends, said plate being unrestrained intermediately of said 5 points of attachment.
42. In a sound box, the combination of a casing, a diaphragm. a stylus bar having a rigid arm, a spring fulcrim, parallel to the face of the diaphragm and having one end 60 fastened rigidly to the rigid arm and its other end fastened to the casing, the said spring fulcrum being flexible between the stylus arm and the casing, and unrestrained interinediately of said points of connection. 65
43. In a sound box, the combination of a casing, a diaphragm, a stylus bar. a flexible spring fulcrum extending from the outer surface of the casing and parallel with the face thereof, said spring fulcrum being 70 rigidly fastened to the casing and the stylus bar. there being a minute flex between the points of comection of the spring, and the latter being unrestrained between its points of attachment.
44. A sound box comprising a casing. a diapluragn, a stylus bar, and a resilient connection extending from said casing in a plane at an angle to the periphery of said casing and attached to the casing and strhs so bar at oppositely disposed ends. silid resilient connection being murestrained intermediately of suid points of attarchnent.

In testimony whereof I have signed my name to this specification in the presence of s 5 two subscribing witnesses.

JOHN A. WHLLIMMS.

Witnesses:
R. H. Monms,
M. E. Hedge.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."


## L. P. VALIQUET.

MOTOR FOR TALKING MAOHINES, APPLIOATION FILED MAY 3, 1904.
987,2'72.
Patented Mar. 21, 1911.
2 SHEETS-SHEET 1.

L. P. VALIQUET.

MOTOR FOR TALKING MACHINES. APPLIOATION FILED MAY 3, 1904.
987,272.
Patented Mar. 21, 1911.
3 SHEETS-SHEET 8.


# UNITED STATES PATENT OFFICE. 

## LOUIS P. VALIQUET, OF NEW YORK, N. Y., ASSIGNOR TO VICTOR TALKING MACHINE COMPANY, A CORPORATION OF NEW JERSEY

IMOTOR FOR TALKING-MACHINES
98\%,2\%2.
Specification of Letters Patent. Patented Max. 21, 1911. Application filed May 3, 1904. Serial No. 206,116.

## To all whom it may concern:

Be it known that I, Locis P. Valiquet, a citizen of the United States, and a resident of the city of New York, State of New York,
5 have invented certain new and useful Improvements in Motors for Talking-Machines, of which the following is a full, clear. and complete disclosure.
The object of my iuvention is to gencrally
10 improve the construction of talking machine motors, so that said motors will run with greater efficiency of power, decreased friction and for a greater length of time than has heretofore been made possille in ma-
1.5 chines of this class.

Bricfly, my invention comprises a plurality of spring barels and springs, which are si geared as to be womd by a single winding shaft, and which may, however. op-
20 erate independently should one of said spring barrels becone inoperative.
My invention also comprises an arrangement of certain gears and shafts so that the same may be removable withont interfering
2.5 with adjacent connecting parts.

My invention also comprises other imprownents in the constration and arrangement of parts as will hereafler be mone fully. deseribed and pointed out in the clatms.
30) For a full, char and exact deserption of this form of my invention, referemere may he had to the following specifiettion, and to the accompanying drawings forming a pat therent, in which-

Figure 1 is a cemtan, pertical. sectional view of the motor med banism showing the genema armagement of pats; F゙ig. o. an end devation of the satme showing that end of

10 plied F lige. :3, an inverted plan riow of the motor :and it- supputing platrof Figs. 1 and $\therefore$ aldaled views of pats of the contrifugal
 spective views of the pawl for locking the

 mathed from the motor.

Int the drawings the supporting platre 1.

50) Fite, is preperally cirentar in motlone and it adupted (1) be retnined in in eotespunting
 a asing in loe nsmal mumbr.

The numeral 2 indientes ller main spindle
or shaft upon which the turntable or record carrier is adapted to be secmed in any suitable mamer. The shaft 2 passes through the hollow sleeve 3. which depends from the recessed portion of the supporting plate 1 and is preferably integral therewith, and which is provided with interior bearings or bushings $t$ and 5 . The upper end of the bushing 4 is flanged at 6 and adapted to form a seat for the bearing balls 7 , which receive the longitudinal weight of the shaft and table; suitable races being formed in the enlarged portion of the shaft 2 , which is disposed within the recess in sinil plate 1 , as indicated at 8 . 10 receive the bearing balls $\tau$. In this mamer the spindle or shaft 2 and the parts carried thereby are momited on an anti-friction thrist learing, and said spintle provides a shonlder sulostantially in a plane with the plane of the upper surface of said plate for smporting the turn-table, mot shown. The shaft 2 has rigidly attached to it- lower end a sleeve!, which earres (wo gears 10 and 11. the former of which is adapted to form a comertion with the cenrifugal governor, ats will be more fully painted out hereafler, and the latter of which will form a pant of a lain throngh which the power from the motor pringe is tramsmiterl. Also depending firom the platw 1. are supporting posts 12: and 13. The posit 12 camies at its lower end anstable learingr (1) - thid for the gear 11 which mele witi the gear or pinion 11, above mentioner.

 "ith a beveded gan 17 fixad on tha horizantal shaft 18. The slan lo 18 has one com jome naled int the puot 12, as imlimateal at 19, Whila



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30 and 31 are adapted to mesh with the pinion 32 which is mounted on a short winding shaft 33 ; said rinding shaft being slotted to receive the key of the usnal wind5 ing crank, as indicated at 34 . The shaft 33 also carries the pawl for holding the gears 30 and 31 in position when the springs are not being wound. This pawl comprises a plate or disk like support 35 , which has two pro-
10 jecting arms 36 and 37 , which terminate 1 n gear teeth 38 and 39. The arms 36 and 3 i are offiset, so that when the support 35 is in place upon the shaft 33 , with its face in contact with one side of the pinion 32 , said arms some opposite the gears 30 ank s1, so that the sets of teeth 38 and 39 will mesh respectively with the teeth of the gears 30 and 31 , when the gear 32 is moved in an anti-clock-wise direction, as in Fig. 6. For forcing the pawl support 35, in contact with the pinion 32, I provide a helical spring 40 , which is confined in its position upon the shaft 33. by means of a collar or a similar device 41.

It will be seen that the frictional contact between the pawl support 35 and the pinion 32 , will cause the teeth of the pawl to be disengaged from their respective gears when the shaft is turned in one direction, and said deeng said gears when said shaft is turned in the opposite direction. Thus a noiseless and positively acting, holding device is provided for the gears 30 and 31 , when the motor springs are not being 37 is limited by a suitable stop, such as a pin 42 , depending from the supporting plate 1. This stop gives just sufficient play to the pawls to allow the gears to be rotated with-都acting with the same when the pinion 32 is turned in one direction, but so that said gears will be immediately rec̈ngaged by the pawls when the pinion is rotated in the opposite direction.

The centrifugal governor used with this form of spring motor is similar to that described and claimed in my prior application filed October 1. 1903, Serial No. 175,302, and is applied in the following manner:hangers or posts 43 and 44 , the post 44 of which has a lateral projection 45 which carries a bearing plate 46 for the shaft 47 of the centrifugal governor. The shaft 47 is: supported at its other end by a post 4 . , shaft $4 \tau$ has. adjacent one end thereof, a screw-thread or worm gear 49, which meshes with the gear 10. and adjacent which is a fixed collar 50. Adjacent the other end of said shaft 57 is a slidable sleeve 51 , which carries at its onter end a circular disk 52. The inner end of the sleeve 51 is provided with a pair of slots or recesses 53 , which engage a transverse pin 54 on the shaft 47 ,
said pin and slot forming a coupling between the sleeve 51 and the shaft 47 . The sleeve 51 is connected with the collar 50 by means of spring strips 55 , which carry the ordinary governor balls or weights 56. A coiled spring 57 surrounds the shaft 47 between the collar 50 and the sleeve 51 , and tends to force the latter outwardly with the disk 52 . The disk 52 is adapted to contact with brake shoes or pads 58, which are carried upon a semi-circular yoke 59, which is fixed upon a horizontal shaft 60 , having bearings in the hanger or support 61 and the post or hanger 27. Said shaft 60 is provided with a coiled spring 62 , one end of which engages the neck of the yoke 59, and the other end of which is held by the plate 1. The yoke 59 and the pads 58 are, therefore, kept under spring tension by a pressure in the direction of the disk 52 . The outer end of the shaft 60 is curved or bent, as shown at 63 , and carrics upon its end a collar 64, which has an inclined surface on its lower side. Passing through an opening in the plate 1 , is a pin 65 . having a milled head, and which is provided on its lower end with a suitable stop 66. which is adapted to bear on the under side of the collar 64 , which surrounds said pin. It will be seen by this construction of the governor and regulator that as the milled head of the pin 65 is turned so that the stop 66 travels from a narrow portion to a wide portion of the collar 64 on the inclined surface, the brake pads or shoes 58 will be retracted from the brake disk 51 , and the motor be allowed to run at a greater speed. The opposite turn of the pin 65 will produce the opposite effect.

The construction of the driving spring and the spring barrel comprises the following arrangement of parts:- The spring barrel 28 consists of a metallic drum which is open at one end and is attached at said end to the gear 30 by means of screws or other suitable devices 67 . Said gear 30 and the spring barrel 28 are respectively mounted for rotation on the rednced opposite ends of the barrel arbor or slecre 68 which is adapted to tur'n in said parts. The driving spring 69 is attached at one end, as indicaten at 50 , to the barrel arbor or sleeve 68 , and its opposite end is attached to the spring barrel. as indicated at 71 . The end of the barrel arbor is provided with suitable recesses i2, which are adapted to engage corresponding projections. or kers, on the shafts 25 and 26. the spring barrels for each shaft being identical in construction. The slot or recess in the end of the barrel arbors and the coöperating keys or projections on the shaft together form a coupling between the barrel and shaft and afford a means whereby the said barrel mar be detached from the shaft without disturbing the rest of the motor as is again referred to below.

In assembling the device, the spring barrels are placed upon the shafts 25 and 26 , so that the recesses 72 engage their corresponding keys, and thumb-nuts 73 are then
5 screwed npon the ends of said shafts to hold the barrel arbors carrying the spring barrels in position thereon. Since both of the gears 80 and 31 mesh with the pinion 32 , either one of the driving springs are effec-
10 tive to drive the motor independently of the other, and shonld one become broken the motor will be driven by the remaining spring, until a new one is provided in place of the broken one. When it is desired to
15 substitute a new spring and spring barrel for one which has been rendered inoperative in any manner, it is only necessary to allow the motor to rin down to release the tension on the springs, after which the spring bar-
20 rels maly be easily removed from their shafts, after simply unscrewing the thumbmints 73.

From the constraction of parts above describerd, it will be seen that I have provided
25 an exceedingly simple and efficient form of motor, in which the parts are easily removable and interchangeable, while at the same time the parts are compact withont being inaccessible from the mader side of the
30 motor, when the cover of the motor casing is in its raised position. Furthermore, by laving the inner end of the driving spring attached to the barrel arbor, the gears 30 and 31 wre not active except in winding the
35 motor. Which greatly rednces the amonnt of friction over the construction where the spring is wound from its imner end and the onter end insed to drive the motor:

Having just described my invention, it be obvions that certanl changes may be made in the form and arrangenent of parts, and different mechanical eqnivalents may be nsed withont departing from the spirit and cope of my invention, but

What I chaim and desite to proted by Letters Patent of the United Statee, is-

1. In a talking machine motor, the combination with the main driving spindle, a bearing teeve therefor, a ball thriat bearinge localed at the "pगer end of satid sleeva and geats camped bex sad spindle adjacent the lower end of said sheree, a contrifngal groverore, power medamism and gearing connecthge salid power mechanism with one of saill geans, the other of said gemst heing commeded with the centrifugal igoverner.
$\because$ In at taking machine motor, the combination with the main driving spimile, of

 steree carriod by the lower and of said spindte having iwo gears lowated llaceons. at (whtilngal governor, power mechanism. :and: powe transmitting truins, Which conneeds with oure of the gembs on said sleeve,
the other of sinid gears being connected with the centrifingal governor.
2. In a motor, a supporting plate, a sleeve depending therefrom, a spindle supported in
said sleeve, a ball thrust bearing in unitary relation with said spindle supported by said plate, a governor, and driving mechanism suitably geared to said spindle.
3. In a motor, a driving spindle suitably snspended and having a sleeve secmred to its lower end, said sleeve being provided with a phrality of gears integral therewith. a governor operated by one of said gears and driving mechanism connected with another of said gears.
4. In a motor. a supporting plate provided with a dished portion, a driving spindle rotatably suspended from said plate in said dished protion. said spindle having an ammular shoulder thereon bearing on said plate below the plane of the upper surface of said plate, a governor, and driving mechanism suitably geared to said spindle.
( 6 . In a motor, a supporting plate provided with a recess in its hpper surface, a driving spiudle rotatably suspended from said plate and having an cularged portion located within said recess and bearing on said plate below the plane of the upper surface of said plate, a governor, and driving mechanism suitably genred to said spindle.
5. Ii a motor, the combination with a rotary spindle having its opposite ends free. of a ball thrust bearing intermediate of the conds of said spindle, a sleere having gearmomited on said spindle leeal to one end thereof, a governor: driving mechanism, and gearing comected to said governor throngh The gears on said spindle and arranged in rotate said spindle.
6. In a motor, a supporting phate provided with a recess in its upper surface, and a driving spindle having an amman portion with a ball thrast bearing on satid plate, the npper face of satid enlatered portion hering sulstantially in a plane conimedent with the plane of the upper anface of said plate, "1 governor, and driving mednanism sultably geared to salid spindte.

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 siticl pinion.
11). In 11 spmine motor for lalling $112: 1$

 -phings, " wimling pinion with which said

engage said pinion, said part having a phorality of arms temmating in teeth adapted to engage each of said gears, and means for rotating said pinion.
7. In a spring motor for talking machines, a plurality of driving springs, winding. gears comnected with said driving springs, a pinion with which said gears are adapted to mesh, a part in frictional en-
is gagement with said pinion having a plurality of arms terminating in teeth adapted to engage said gears, a spring for keeping said part in contact with said pinion and means for rotating said pinion.
8. In a talking machine motor, the combination with a pair of driving shafts, of a spindle geared to said shafts, spring driving mechanism on each of said shafts provided with winding gears, a single winding shaft for smultaneously winding the spring driving mechanism on said respective shafts, and means frictionally actuated by the rotation of said winding shaft, and carried thereby, operative to engage said gears when said winding shaft is rotated in one direction and to disengage said gears when said winding shaft is rotated in the opposite direction.
9. In a motor, a driving shaft, driving a common plane and actuated by said driving mechanism, a pinion connecting said gears, a shaft for said pinion, and a doubleended pawl arranged to be shifted to engage each of said gears by frictional engagement with said pinion when rotated in one direction and frictionally shifted by said pinion to disengage said gears when rotated in the opposite direction.
0 14. In a motor, a pair of parallel driving shafts, winding gears mounted thereon, a windling shaft provided with a pinion meshing with said winding gears and an annular disk mounter on said winding shaft and said ammular disk being provided with radially extending arms forming pawls engaged with -aid winding gears.
10. In a motor, a driving spring. a winding slaft. a pinion momed on said winding shaft and meshing with said gear, a pawl loosely supported on said shaft and frictionally engaging sald pinion and having a plurality of teeth operative to be moved into and ont of mesh with the teeth of said gear by said pinion, and means for limiting the movement of sald pawl away from said gear.
11. In a talking machine motor, the comoppor with a main arino spind bef a supporting plate therefor: a thrust bearing located upon the onter side of said plate, gears carried loy the free end of said spindle, a centrifugal governor, power mechanism, and gearing connecting said power mecha-
nism with one of said gears, the other of said gears being comected with the centrifugal governor.
12. In a talking machine motor, the combination with the main driving spindle, of a supporting plate therefor, a thrust bearing adjacent the outer side of said plate, a sleeve carried by the inner free end of said spindle having two gears located thereon, a centrifugal governor, power mechanism and a power transmitting train which connects with me of the gears on said sleeve, the other of said gears being connected with the centrifugal governor.
13. In a talking machine motor, the combination with a supporting plate, of a main driving shaft rotatably mounted therein, a pair of parallel shafts rotatably supported upon said plate, a gear loosely mounted upon one end of each of said shafts, and a spring connection between each gear and its shaft, a winding gear meshing with both of said gears, and means to lock said gears in a fixed position, gears upon the opposite ends of said shafts rigidly secured thereon, a pinion intermeshing with said last mentioned gears, a shaft carrying said pinion and rotated thereby, a governor and means between said last mentioned shaft and said governor and between said last mentioned shaft and said main driving shaft for driving the same.
14. In a motor, the combination with a rotatable driving shaft, of a sleeve slidably momnted thereon, said sleeve having reducer! ends, a gear mounted upon one of said reduced ends and rotatable with respect thereto, and having a cylindrical boss, a pring barrel secured to said boss and journaled upon the other of said ends, and a spring having its opposed ends respectively secured to said barrel and said sleeve.
15. In a talking machine motor, a pair of driving shafts, a spindle geared to said shafts, a spring driving mechanism on each of said shafts provided with winding gears, a single winding shaft, a pinion rigidly momed upon said shaft for simultaneously winding both spring driving mechanisms, a pawl engaging said winding, gears and comprising two oppositely projecting arus loosely monnted upon said winding shaft and engaging against the side of the said pinion, and yielding means to hold said pawl in frictional engagement against the side of said pinion, whereby said winding shaft is free to be rotated in one direction to wind up the spring driving mechanism. said pawl being inoperative during said winding movement, but being automatically thrown into engagement to prevent the unwindling of the said winding pinion.
16. In a talking machine motor, a pair of parallel driving shafts, a bearing for each 130
shaft, the end of each shaft extending freely outwardly from its bearing, a spring driving mechanism mounted upon the free end of each shaft, a retaining member to 5 hold each driving mechanism in position, spring winding mechanism for said spring driving mechanisms and a single winding shaft for simultaneously operating both spring winding mechanisms located between said mechanisms, and extending outwardly in the direction of, and parallel to the free encls of said driving shafts, said driving mechanisms being freely removable from said driving shafts upon the removal of said retaining members.
17. In a motor, a driving sliaft suitably mounted, a sleeve rigidly secured on said shaft, a gear loosely journaled on said sleeve independent of said shaft, a spring casing connected with said gear, a coiled spring secured at its outer end to said spring casing and at its inner end to said sleeve.
18. In a motor, a driving shaft suitably mounted, a sleeve mounted on said shaft and interlocked therewith, a winding gear and a spring casing rotatably mounted to rotate on said sleeve indepentent of said shaft, and a coiled spring in said casing having its onter end secured to said casing and its inner end seenred to said sleeve.
19. In a motor, the combination with a rotary spindle, of a ball thrust bearing intermediate of the ends of said spindle, : plurality of gears carried by said spindle, a stationary bearing sleeve embracing said
spindle intermediate of said gears and said bearing, and forming a bearing for said spindle, a governor, driving mechanism, and gearing connecting said driving mechanism with said governor through the gearing on said spindle, to contemporaneously actuate said spindle and governor.
2.5 . In a motor, a driving shaft rotatably supported on spaced hangers and having a free end extending beyond said hangers. a sleere mounted on said free end, means for rigidly comnecting said sleere to said shaft, a winding gear loosely mounted on said sieere, and a coiled spring having its outer end secured to said gear and its immer end secured to said sleeve.
20. In a motor, a driving shaft rotatably supported on spaced hangers and haring i free end extending beyond said hangers, a sleere monnted on said free end, means for rigidly connecting said sleeve to said shaft. said means comprising interlocking elements between the inner end of said sleeve and said shaft and means for holding said elements in engagement with each other, a 60 winding gear loosely mounted on said sleeve. and a coiled spring having its outer end secenred to sald gear and its imere end sromed to said sleere.

In witness whereof I have heremto set 65 my hand this $30 t h$ day of 1 pril. A. D. $190+$. LOUTIS P. YALIQUET.

## Witnesses:

Adolf Ácimincle.
Frank G. Swarmotr.

Coples of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
A. FISCHER.

SOUND BOX FOR TALKING MACHINES. APPLICATION FILED JULY $1,1000$.
989,139.
Patented Apr. 11, 1911.


# UNITED STATES PATENT OFFICE。 

ALEX FISCHER, OF KENSINGTON, LONDON, ENGLAND.
SOUND-BOX FOR TALKING-MACHINES.
$\mathbf{9 8 9}, 139$.
Specification of Letters Patent. Patented Apr. 11, 1911. Application filed July 1, 1909. Serial No. 505,472.

## To all whom it may concern:

Be it known that I, flex Fischer, a subject of the King of England, residing at 8 Maclise road, Kensington, in the county of
5 London, England, have invented certain new and useful Improvements in Sound-Boxes for Talking-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will
10 enable others skilled in the art to which it appertains to make and use the same.

This invention relates to bearings for mounting a stylus on sound boxes of talking machines, and has for its object the im-
15 provement of the bearings and coacting parts described in my former Patent Number 904,523 , November 24,1908 , sound boxes for talking machines.

To these ends the invention consists in the
20 details of construction and novel combinations of parts more fully hereinafter disclosed and particularly pointed out in the claim.

In my former patent above, the spindle $c$
25 is mounted in brackets 6 provided with bearing surfaces concentric with the curved portion of said spindle $c$ and the centers of which lie within said spindle. In the present improvement, however, I substitute for
30 thesc other curved surfaces with their centers outside of the spindle $c$, as will appear bclow.

Referring to the accompanying drawings forming a part of this specification in which
35 like letters refer to like parts in all the views:-

Figure 1, is a front elevational view of a sound box with my improvement applied thereto: Fig. 2 is a side clevational view of
40 the parts shown in Fig. 1; Fig. 3, shows a modified form of construction according (o) the present invention; Figs. 4 to 7 show details of the bearings hereinafter refered to; and, Figg. 8 , shows a perspective view of the
45 stylus and associated parts.
$a$ is the shell of the somm bow provided with guide bearings b. It will be observed from Tigs. 1 to 7 that hase bearinegs are of concave form, and ante a small segment of a circle.
$c$ is the spindle bearing which, as in the patent above, may be cirentar or partly cir cular in cross section.

In Figs. 2 and 4 the radins of curvature of the spindle is smaller thum the rmbins of curvature of the gnide bearing surlace $b$,
while in Fig. 5 the radius of curvature of the spindle $c$ is the same as that of the guide bearing surface $b$, but in each case the center of the circle, of which the bearing surface $b$ is the circumference instead of falling within said spindle $c$, falls considerably outside the same.
$k$ shows spiral controlling springs and $h$ shows hollow nuts. 9 is a flat spring preferably attached by a screw to the side of the spindle $o$ opposite the bearing surface, the other end being slotted and having a screw 10 passing through such slot into the shell $a$ of the sound box.

Referring now to the form shown in Fig. 3, which is intended more especially for the construction of a cheaper sound box than that described, in this case the springs $7_{i}$ hollow nuts $h$ and brackets $g$ shown in Fig. 2 of the dravings of the patent above, are dispensed with, and in their place a second flat spring 9 is attached to the side of the spindle $c$ oppositc its bearing surface as seen on the left of Fig. 3.

Referring to the details shown in Figs. © and 7 which are edge views of two forms of guide bearings $b$, the guide bearing shown in Fig. 6 is made of a thin plate, while the guide bearing in Fig. $i$ is made with a beveled bearing also.

From the construction now disclosed, it will be evident since the centers of curvature of the bearings b and e fall mitside of the spindle $c$, that not only will all the freedom of motion be permitted that is possessed by the corresponding structure of my paterit above, but in addition to such motion the present structure euables the spindle e to have a slight sidewise motement in the bearing b. Lh other words satid spinille mas. in a sense, be considered as comstimbing tha fulerman of a bent lever, one end of ane arm of which terminates in the needle point :nnd the end of the ofter arm of which is connected to the stylns bar. Fimther, the hearinge $h$, therefore, embles the spintle e constifuting tho fuldun of this leyer to be lat anlly shifted, und to move agminst the puat of the springs and the pull of the diaplatisul minder the stresses imparted by the travelage record.

It is furthere evident that the strudme in the pallent abote wombl be minsuitable to permit this luteron shifting of the filfermun so 110 longer as lle centers of curvilume of the bear ing gie with the spimille ce. It is ulat eni-
dent, if the bearing surface of the part 7 is made straight, too much play will be allowed the spindle $c$. In practice I have found a convenient length of radius for the curvaof the said bearing to be about equa to the length of the lever above, although, of course, this may be raried without destroying the beneficial effects of the invention.

What I claim is:-
In a talking machine, the combination of a casing; a diaphragm in said casing; a pair of concavely curved guide bearings rigid with said casing; a spindle provided with
with said first mentioned bearings, the center of curvature of each of said first mentioned bearings being located outside of said spindle, and the radius of curvature of said spindle being less than the radius of curva- 20 ture of said first mentioned bearings; and a stylus bar attached to said diaphragm and spindle, substantially as described.

In testimony whereof, I affix my signature, in presence of two witnesses.

## ALEX FISCHER.

Witnesses:
Lily Simmonds, A. E. Vidal.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."
M. GRAFT.
aUtomatic magazine needle holder. APPLICATION FILED JUNE $16,1910$.


Max SHaft,
WITNESSES:
Gonmasoous
sinew fawn

# UNITED STATES PATENT OFFICE. <br> IMAX GRAFT, OF PHILADELPHIA, PENNSYLVANIA. 

AUTOMATIC MAGAZINE NEEDLE-HOLDER.
$989,544$.
Specification of Letters Patent. Patented Api. 11. 1911. Application filed June 16, 1910. Serial No. 567.225.

## To all whom it may concern:

Be it known that I, Max Graft, residing in the city and comnty of Philadelphia, State of Pennsylvania. have invented a certain 5 new and useful improvement in a certain automatic magazine needle-holder to be used in disk talking-machines in applying a new method of using needle after needle without removing the same immediately 10 after playing a record.

The invention applies to all disk talking machines and consists of a multiple revolving needle holder mounted on a supporting arm by which attachment is made to the re-
15 producer of the talking machine.
The whole contrivance operates in such a way as to allow all the needles to be used consecutively and afterward removed all at one time, and others put in their place.
20 This derice may be made of gum metal, ahuninum, brass, irm, steel, nickel or other material or materials.

Figure 1 represents a rear elevation. Fig. 2 a front eleration with outer plate ant
25 thmbscrew removed. Fig. 3 represents a central section and Fig. 4, is an assembly of all the parts showing the connection with the reproducer M of the machine, as the device would appear in actual use with nee-
30 dles in place resting upon the record I which is supported on the turntable R.

This derice consists of a supporting armı 1) Figs. 1-2 and 3 on which is momed two (ircular plates 1 aud J Fig. 3, separated 35 from the supporting arm D by a washer K Fig. 3 to prevent the rubbing of the lower plate $A$ and the supporting arm I). These two plates A. and J revolve upon a pin C Figs. 1-2 and 3 throngh their center and are clamper rogether by means of a thmomberew II Fig. 3 which works in and out on a thread cut in the outer end of the pin or axle C. This pin or axle passes through the supporting arm D) Figs. 1 and 3 and momnts on its inner cund a foothed wheed (i Fige 1 and is which operates against a dog 18 Figss 1 and 3 so as to form a matchet. The erntral pin on axle $C$ is marle to monde freely throngh the supporting anm 1) unt onter or cover plate of as shown in Fix. 3 but is fust in the lower disk or phate $I$ mat thom ratehet whed (i. The imere cimentar platw (1) disk 1 Figs. 1 -2 mad $: 3$ is slotterd on grooval as shown at B Figs. 2 und is on
65) Tines radiating from its conter fo such a
width and length as to properly acconmodate the metallic needle now used in the playing of disk talking machine records. These needles as shomu dotted in Fig. 2 are held firmly in place ly means of the outer cover or clamp plate J Fig. 3 trich is circnlar and of the same diameter as the inner magazine plate A Fig. 3 and is held against it by means of a thumbscrew H. Fig. 3 operating on a screw thread cut in the central 65 pin C as shown in Fig. 3.

On the outer surface of the cover plate $J$ a star or other mark is made to provide a starting point so that none of the needles may be used a second time. When the thimbscrew II Fig. 3 is turned so as to jam the two plates A. and J together and thus firmly secures the needles in the pockets or grooves of the plate $A$ arditional rotary presure on the thumbecrew in a clockwise direction will canse each needle to consecntively assume a rextical position and ready for playing, being so controlled by thi ratchet arrangement $G$ and F Fig. 3. 1 reverse motion of the thmmbscer releases the cover plate $J$, thus enabling the needles to be removed and the magazine refilled? again.

The whole contrivance may be attached to the reprodncer M Fig. \& he inserting a pin E Figs. 1 -2 and 8 (which is made fast to the supporting arm I) Fig. 3) in the serew wr needle clamp of the reprodued as shown at Y and N Fig. t. The pin at the end of the supporting arm inserted in the neetle or serew elamp of the reproducer can be rombl. square or any other shape.

Slight modificalions might loe mate in the constraction heme slown without departinge from the spirit of me invention, and I there fore do not wish to be limited to its mated (wnstruction.

What I rlnim is:-

1. A dewere of the chase recited comprising a fixed stpport, a motatable disk-like mem bere cmippent with a plurality of radially
 Whmping said meatlos with resped to the said member and ments for prombine ret rograde musement of said member:
$\because .1$ den iow of the elase recited compromer a lived -mpory a disk libe member provided wibs a phombty of radinlly cxtomdine


for clamping said needles within said grooves and means for preventing retrograde morement of said member.
2. A device of the class recited comprising

5 a fixed support, a disk-like member prorided with a plurality of radially disposed grooses rotatably mounted with respect to said support, a needle within each groove, a remorable plate for preventing the es-
10 cape of the needles. means for clamping the plate to place and means for preventing retrograde morement of said member.
4. I device of the class recited comprising a fixed support, a pin having a screw-thread15 ed end extended therefrom and free to rotate with respect thereto, a disk-like member rotatable with said pin, said member be-
ing provided with a plurality of radially disposed needle receiving groores, needles for said grooves, a plate for preventing the escape of said needles, a thumb-screw for clamping the plate to the said member whereby said member may be rotated clockwise by said thmb-screw and means operatively comnected between said support and member for preventing retrograde morement of said member.

In witness whereof I have hereunto fixed my signature in the presence of two subscribing witnesses.

MAX GRAFT.
Witnesses:
E. M. Aampson,

Jos. F. Sonlelzbicil.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

## J. HARRIS.

SOUND RECORDING AND REPRODUCING MACHINE.
APPLIOATION FILED SEPT. 8, 1909.
Patented Apr. 18, 1911.
5 SHEETS-SHEET 1.

J. HARRIS.

SOUND RECORDING AND REPRODUCING MACHINE.
989,707. APPLIOATION FILED SEPT. 2, 1909.

Patented Apr. 18, 1911. 5 SHEETS-SHEET 9.


## J. HARRIS.

SOUND RECORDING AND REPRODUCING MACHINE,
989,707.
Patented Apr. 18, 1911.
5 SHEETS-SHEET 3.


## J. HARRIS

SOUND RECORDING AND REPRODUCING MACHINE.
APPLICATION FILED SEPT. 2,1909
Patented Apr. 18, 1911.
5 Sheets-sheet 4

Fig. 3.


Fig. 4.
Fig. 5.


Truenzor



## J．HARRIS．

SOUND RECORDING AND REPRODUCING MACHINE．
989，707
APPLIOATION FILED SEPT．2， 1809.
Patented ADr．18， 1911. 5 BHEETA－AHEET 6.


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## UNITED STATES PATENT OFFICE.

## JULIUS HARRIS, OF LIVERPOOL, ENGLAND, ASSIGNOR OF ONE-HALF TO THOMAS KING

 EMERY, OF LISCARD, ENGLAND.
## SOUND RECORDING AND REPRODUCING MACHINE.

To all whom it may concern:
Be it known that I, Julius Harris, a subject of the King of England, residing at Liverpool, in the connty of Lancaster, Eng5 land, have invented a new and useful Sound Recording and Reproducing Machine, of which the following is a specification.

This invention has reference to phonographs, gramophones, and other similar 10 auto-musical instruments, and instruments driven by spring motors, and especially those in which the records are of the disk type, and the general object of the invention has been to provide improvements in connection
15 with such instruments by which they are more easily worked and at the same time the mechanism is simple, inexpensive, and effective, and capable of giving uniform and reliable results or effects, both in the taking of 20 records, and in playing them.

This invention will be described with the aid of the accompanying dravings. which illustrate an auto-musical instrument of the character herein referred to, and in which 25 the improvements hereunder are conprised.

In these drawings, Figure 1 is a plan of one part, and Fig. $1^{\wedge}$ a plan of the other part of the improved mechanism, and Fig. ‥ is an elevation partly in seetion of the im-
30 proved mechanism. Figs. 3, 4, and 5 are details hereinafter described, and Fig. of shows a part of the hand actuating means.

1, generally designates a rocking frame: 2 is a spindle on whieh the record table 3 is
35 momited; 4 is a pivoted spindle on which the frame 1 is momoted and about which it roeks; and is is the nsmal spring motor which is womed up by the morement of the frame.

The frame 1 has comected with it a lever
40 f , which is adtuated by hand in the manmer bereinafter described: and the frame is comneeted with the spring motor to by a chain $t$, one end of which is commeded in with the frame itself, and the other with the rater of of
45 the spring motor 5 ; white one end of the spring is emoneeted to the rase and the orther with an arhon ?, which has fixed on it a toothed paw when 10, which is hod agamed matam in one diredion he the pawts 11.

The frame 1 carves erabine be which mesdion is imparted to the records disk and the
mechanism comected with the same through a fixed eurved rack 13 , which is attached to the carrier bed 14 of the machine, and is held stationary thereon. This rack serves to 55 operate the gearing carried by the frame 1. through a part of the said gearing engaging with such rack and being caused to travel over it by the spring motor 5 which is connected with the frame 1 by the chain $\pi$.

The gearing carried by the frame comprises a tooth wheel 15 which engages with the curved rack 13, and as the frame is moved by the spring motor 5 through the chain 7 , the tooth wheel 15 is rotated br the teeth of the curved rack 13 , and the spindle 16 of the tooth wheel also rotated. and such rotation of the spindle 16 is transmitted to the bevel wheel 20 through the medium of : ratchet wheel 19 fixed to the spindle 16 and a spring pressed pawl 18 attached to the wheel 20 and which engages with the teeth of the said ratchet wheel 1 .

The ratchet wheel 19 and spring pressed Dawl 18 are provided for the purpose of 7 enabling the spring motor 5 being wound without operating the gearing. that is, when the frame 1 is rocked on its spindle $t$ away from the spring motor the gearing carried her the frame is "freed". that is. the spindle so 16 and ratehet wheel 19. rotate freely owing to the pawl 18 slipping over the teeth of the ratechet wheel.

The rotation of the berel whel ㅇot transmits motion to the hevel pinion 21. and -pindle 22 , and the spindle 2.2 rotates the spimal tooth wheel 23 , and a worm 21 on the resord disk table spindle 2: the motion is impartent to the said toothed whecls and spiral ant whom gearing, her cansing the footh wher 12.90 to move over and in engagement with the stationary rack 13 by the spring motore os and the remom is rotated at the rempired spered. which is requlated as nex deseribed.

The speed of rotation of the disk and its spindle $\because$ is mentated he the exemon devion 12 mome particnlarly shomin in fige. 3. This deries is of the well komon chatedere and is driven throngh the tooth when as momited on the rewod tabla spindle $\because$ and and a tooth pinion of gemring themwill and momed on ther spindle of the sempromer de
vice 12. The governor device comprises weighted spring arms which in rotation fly or move outwardly from the spindle of the governor device, and pull or move down-
5 ar a disk $2 f$ on to the end 28 of a lever 29 , which is pirotally mounted at 30 . The position of the end 28 of the lever 29 relatively to the disk 27 , is regulated by a thumb regulating mut 31. which screws on to the
10 upper end of the spindle 4 , (on which the frame 1 is carried.) and has a conically shaped lower end which acts directly upon a pin 32 attached to the outer end of the lever 29. The end 28 of the lever 29 is normally
15 pulled away from the disk 27 by the spring 33, attached at one end to the lever 30 , and at the other end to a part of the casing, and when the end 28 is to be moved toward the disk, the nut 31 is screwed farther on to the
20 screw threaded end of the spindle 4 , and rocks the lever 29 about its pivot 30 in such a manner as to move the end 28 of the lever toward the disk 27 . The end 28 serves as a braking device for the disk 2 2, that is, when
25 the disk 27 is pulled downwardly by the weighted spring arms of the governor, the disk bears against the end 28 , and the speed of rotation is checked or reduced thereby.

The end of the lever 29, may have an anti-
30 friction roller or ball upon it. which works in connection with the monder side of the disk 27.

The sound box is mounted on gimbals as shown in Figs. 4 and 5, to give lateral play
35 or morement and the proper adjustment and the needle will be pressed ont o the record disk 10 by gravity, or by a slight spring.

The gimbals consist of an inner ring 38, to which the somnd box tube 37 is connected
40 by pins 39 ; and the ring 38 has pins 40 on it, which are mounted in the outer ring 41 directly commected with the trimpet tube 42 , which will be fixed or stationary, and is without a sound arm. By this arrangement,
45 it will be noted that the sound box 35 will have lateral play as well as rertical play, and the needle is free to follow the impressions of the disk readily and accurately.

With regard to the spring 5 , this may be
50 of a single type, or consist of two or more laminx or springs.

The whole apparatus and parts described are monnted upon a suitable box, table or base 45 ; and the actuating lever 6 is pref-
55 erably operated by a hand crank lever $t 6$ on the outside of the box, which is comected up with the lever of through a spindle 47 . a drum or wheel 48 upon it, and a chain 49 which wraps around the drum. By moving
60 this lever 46 , say about lialf a revolution, the frame 1 will be completely moved from its terminal position to the starting position, that is, it will be fully set. so that upon re-
lease; the complete action of the mechanism and record table will follow.

The winding of the motor spring, and the setting of the instrument generally, is effected by rocking or moving the frame or part carrving the spindle on which the record table is mounted, away from the spring motor; and when this frame is released, the spring which has been wound up returns or mores back the frame, and drives throngh the said toothed and other gearing and the stationary rack, the record spindle and record disk.

As the frame and gear are mored or actuated by the spring motor the disk will be moved relatively to the style or needle of the sound box; and the record will traverse 80 therefor under the style or needle.

What is claimed is:-

1. In a sound reproducing or recording machine, a power motor, a record disk table, and a morable record table carrying part, having a flexible connection with the motor, whereby the latter is wound up when said part is moved in one direction, and said part is mored in the opposite direction by the motor when the latter is released.
2. In a sound reproducing and recording machine: the combination of a spring motor: a fixed toothed rack. a rockable frame on which are mounted a table for carrying the record, a spindle connected with the table, a governor device, and gearing for transmitting motion to the spindle including a toothed wheel which engages with the fixed rack, and a ratchet derice; flexible means commecting the frame with the spring motor : and means for moving the frame away from the spring motor.
3. In a sound reproducing and recording machine; the combination of a spring motor; a fixed curved toothed rack; a rockable frame on which are monnted a record carrying table fitted with a spindle, a governor device. and gearing connected with the said sppindle and which includes a ratchet device and a toothed wheel which engages with the fixed curved rack; a chain connecting the frame to the spring motor; means for rocking the frame away from the motor; and means for regulating the braking action of the governor device.
4. I sound reproducing and recording machine, comprising a spring motor; a stationary curved rack: a rockable frame comprising a record carrying table fitted with a spindle a spring goveruor device. having a braking disk, and gearing which includes. a ratchet device and a toothed wheel which engages with the curved rack: a chain connecting the frame to the spring motor; a hand actuated means for rocking the frame away from the spring motor; a spring ac-

855

-

tuated braking lever having means for regu-
lating the position of the lever relatively to lating the position of the lever relatively to the braking disk of the governor; a sound box; and means for supporting the sound 5 box over the record table including gimbals which enable the sound box to move both vertically and horizontally, and comprise concentrically disposed rings fitted with
horizontally and vertically disposed pins and bearings.
In testimony whereof I affix my signature in presence of two witnesses.

JULIUS HARRIS.
Witnesses:
Somerville Goodall, Donald Coulter.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

## G. H. UNDERHILL.

SOUND REPRODOCING OR SOOND RECORDING MACHINE.
APPLIOATION FILED JONE $11,1904$.

989,737.


Patented Apr. 18, 1911.
G. H. UNDERHILL.

SODND REPRODOCING OR SOUND RECORDING MACHINE.
APPLIOATION FILED JUNE 11, 1904.
989,73\%.
Patented Apr. 18, 1911.
5 SHEETS-SHEET 2.



Witnesses:
Horace S. Erosuman.
Gunct SP Gunuy.

Fig. 5


Truvertor:
George H. Unatertazl. by Emeny Borith Porrell
G. H. UNDERHILL.

SOUND REPRODUCING OR SOUND RECORDING MACHINE. APPLIOATION FILED JUNE $11,1904$.
989,737.
Patented Apr. 18, 1911.
5 SHEETS-SHEET 3.

$\qquad$
G. H. UNDERHILL.

SOUND REPRODOCING OR SOOND RECORDING MACHINE. APPLIOATION FILED JUNEI1, 1904.
989,737.
Patented Apr. 18, 1911.
5 Sheets-sheet 4.

G. H. UNDERHILL.

SOUND REPRODUCING OR SOUND RECORDING MACHINE.
APPLIOATION FILED JUNEIl, 1904.
989,737.
Patented Apr. 18, 1911.
5 SHEETS-SHEET 5.
Fig. 16


Fig. 18


Wizresses:
Horace Gs Grosman:-
Eunith S. Euncy.

Tnvenzor:
George H. Unalexhill.
by Emery Qurih Pomele

# UNITED STATES PATENT OFFICE. 

GEORGE H. UNDERHILL, OF BOSTON, MASSACHUSETTS

## SOUND-REPRODUCING OR SOUND-RECORDING MACHINE.

Specification of Letters Patent. Patented Apr. 18, 1911.
Application filed June 11, 1904. Serial No. 212,079.

To all whom it may concern:
Be it known that I, George H. Underhill, a citizen of the United States, residing at Boston, in the county of Suffolk and State
5 of Massachusetts, have invented an Improvement in Sound-Reproducing or Sound-Recording Machines, of which the following description, in connection with the accompanying drawings, is a specification, like
10 letters on the drawings representing like parts.

My invention relates to improvements in sound-reproducing and sound-recording machines. While applicable in many of its fea-
15 tures to sound-reproducing machines of various types employing but a single record, it is directed more particularly in certain of its fcatures to multiple record machines or those wherein there are employcd a plurality
20 of records adapted to be brought successively into reproducing or recording relation to suitable reproducing or recording mechanisms.

My invention will be best understood by reference to the following description, when
25 taken in connection with the accompanying illustration of one specific embodiment thereof selceterl for illustrative purposes only; while its scope will be more particularly pointed out in the appended claims. the drawings,--rigure 1 is a side elevation of the cmbodiment of my invention selected for illustration, certain of the parts being broken away for clearness; Fig. 2 is a detail showing in section the swivel or
35 jointed attachment of a record cylinder support; Fig. 3 is a detail of the tilting sound bov rest ; Fig. 4 is a front elcration partially broken away, of the machine illustrated in Fig. 1. Fig. 5 is a section, partially broken
40 away, taken on the line o- 5 of Fig. I, but shown on an entarged seale. Fig. fo in a plan view of the machine ilhistrated in Fig. 1. Fig. $\bar{z}$ is a detail of the feed serew soming. Fig. 8 is a side elevation, and Fig. 9 : a front
 fentures of my invention ure upplicable to
machines other than multiple record machines, and to multiple record machines employing carriers widely different from that herein illustrated, by preference I employ a flexible, endless, multiple record carrier in the form of two chains, composed each of individual units or links, $a$ a, passing over suitable guiding means as the sprockets, $b b$, and carrying between them the suitable supports, as the rods, $c \quad c$, upon which are secured the record supports, herein the cylinders, $d$.

Referring more particularly to Figs. 1, 4, 12 and 13, each individual unit or link is composed of two parallel link members, $a^{\prime}$ and $a^{2}$, provided with the washers $a^{3}, a^{4}$ and $u^{5}$, the washers, $a^{3}$ and $a^{5}$, preferably acting as rolls, and washer, $a^{4}$, as a rigid separating and binding member between the two links. Elongated and preferably rigid tic members $a^{6}$ extend from one chain to the other, thereby joining one link flexibly to another and acting to maintain in fixed relative position the corrcsponding units of the two chain carriers.

The sprockets, $b$ b, are suitably recessed to receive and firmly seat the washers, $a^{3}, a^{4}$. $u^{5}$, each alternate recess being larger than the adjacent one to receive the washer, $a^{4}$, which is of greater diameter than the washcrs, $a^{3}$ and $a^{3}$. Adjacent links of the chain are comected together by dovetailed joints. each link of the chain bring provided (Fig. 13) with end recesses, $a^{7}$, to receive the projecting ears, ur $^{\circ}$, of the next adjacent link, the adjacent links being thus pivatally secmed ongether by the tie-rods, $a^{\prime \prime}$. which pass throngh in each chain warier the emds of the two links and the sprocket-engaging Washer: 'The tie-rods, u", ate powded. (Fig. 4), with hexagonal on other stitably shaped heads. "". Wy which the "pposite ihreaded cond thereof are semed agianst shomblers. $\|^{1 "}$, bearing ageninst the indide member of the opposite and enmerember link. The ehat tinks am peforaluly provided with hoss, a $^{11}$. the hag of ome link resting against the back of the mest adjacent link when depembing as shomm in lige. I, theredy to mandath the te
 sub-antially wortionl preition.

Ball link or recod eareming imit is ardmed ta sub-tantinlly ronform in slapo "ith the prepherery of the ernidiner sprowled. and. when in engagement therewth, and partioularly "hem supporting its reened in op-
erative position, receives support from its sprocket, not only through the washer, $a^{4}$, co-axial with the cylinder and on each side thereof through the washers, $a^{3}$ and $a^{5}$, co5 axial with the tie-rods, $a^{6}$, but also through the intermediate, projecting, peripheral portions of the sprocket which enter between and engage with the inner walls of the separated links. The tie-rods, $a^{6}$, hold the cor-
10 responding links in fixed relative position and form in effect a substantially rigid frame-work on which the record is supported and journaled, and this frame-work when its record is brought into operative po-
15 sition, by means of the effective interlocking engagement of each link with its sprocket, gives to the record a firm, unyielding and extended lateral support on either side of the axis of the record and at each end 20 thereof.

The use of the flexible endless carrier described permits the utilization of any desired number of records without varying the dimensions or altering the proportions
25 of the machine itself or the mechanism required to operate it, since the chains may be lengthened to accommodate any desired number of record cylinders, the cylinders out of engagement with the sprocket de-
30 pending idly below the frame of the machine, an additional guiding device as the sprocket, $b^{x}$, being employed, if desired, at the farther end of their travel.

Referring more particularly to Figs. 4 35 and 5 , each cylinder, $d$, is rigidly secured to rotate with its spindle support, $c$, the latter being supported between the two endless carriers during its entire travel. In order to permit a ready withdrawal of any record
40 from its cylinder, I provide means temporarily for swinging one end of the cylinder away from its carrier, the opposite end thereof having a swinging or swivel support to permit this morement. This is effected
45 by providing upon one of the carriers the cap, $d^{\prime}$, suitable secured to the middle or crown of the link, $a$, said cap having a pocket containing the spring-pressed pin, $d^{2}$, the head, $d^{3}$, of which enters a suitable re-
50 cess in the end of the cylinder spindle, $c$, thereby to provide a journal therefor. The end of the pin, $d^{2}$, carries an exterior thumb piece, $d^{4}$, by which the pin head, $d^{3}$, may be withdrawn from the cylinderspindle against
55 the pressure of the spring, and that end of the cylinder thereby left free to be swung outwardly as indicated in Figs. 2 and 6, for the withdrawal of the record. At the opposite end of the spindle, $c$, is rigidly secured
60 the spherical bearing, $d^{5}$, which rests in a socket formed by the outer member of the link. $a$, and the intermediate washer, $a^{4}$, so as to permit of free rotation of the spindle, $c$, within the said socket, and also permit
for the withdrawal of its record. As will more readily appear from Fig. 2, the inner member of the chain link is suitably slotted to receive the neck of the spindle immediately within the ball, $d^{5}$, and to permit the outward swinging of the record-carrying crlinder whenever the pin, $d^{3}$, is withdrawn from the spindle recess. To reduce the bearing friction to a minimum the inner end of the pin, $d^{3}$, is suitably shaped to bear against a ball, $d^{3}$, which is fixedly secured within the cup-shaped bottom of the spindle recess. Thus a record may be removed from its support at any desired point in the travel thereot by merely detaching its support from one point of attachment and swinging it about its point of swiveled attachment into a position where the record may be readily withdrawn.

The sprockets are rigidly secured to a carrier shaft, $b^{\prime}$, suitably journaled in the frame of the machine, (Fig. 9), a spring, $b^{2}$, or any other suitable means being employed for provicling a constant rotative effect upon the sprocket shaft, $b^{\prime}$, to cause movement of the record carriers into and out of operative relation with the recording and reproducing mechanism, which herein is located above the machine, the uppermost record being the one in operatire position.

During recording or reproduction the cylinder, $d$, is rotated at uniform speed through any suitable, and preferably, electric motor (not shown), driving the pulley, e, secured to the sleeve, $e^{\prime}$, the latter being journaled in the frame of the machine, A. Slidable within the sleeve, $e^{\prime}$, is the cylinder drise shaft, $e^{2}$, to the head, $e^{3}$, of which is secured the collar. $e^{4}$, by means of the pin, $e^{5}$. The shaft, $e^{2}$, and its head, $e^{3}$, are mormally spring-pressed inwardly toward the record carrier, the sleeve being slotted to receive the pin, $e^{5}$, and permit relative movement between the sleeve and collar, $e^{4}$, the latter moving inwardly and outwardly with the shaft. The inner end of the shaft $e^{2}$ is suitably shaped to enter a corresponding recess in the end of the alining cylinder spindle, $c$, suitable projections, $e^{6}$, upon the shaft interlocking with corresponding recesses in the spindle to effect the driving morement.

During the rotation of the cylinder and the record carried thereby through the chriving connections described, the sound box and stylus carrying mechanism, B, are progressively moved a long the face of the record from one end thereof to the other. To effect this the sound bos. B , is mounted in a yoke, $f$, slidably supported (Figs. 6 and 10) iupon the shaft, $f^{\prime}$ and carrying (Fig. 1) at its opposite end the depending arm, $f^{2}$, provided with the adjustable slicling support, $f^{3}$, resting upon and slidable along the tilting rest, $f^{4}$. (Fig. 1) hinged in the frame-work, $\Lambda$. During recording or reproduction, the rest. $f^{4}$,
is normally in the position shown in Fig. 1, and the finger, $f^{5}$, (Figs. 1 and 10) secured to the yoke carrier $f$ on the opposite side of its fulcrum support, $f^{\prime}$, is thrown down-
5 wardly to canse the sectional nut. $f^{6}$, held at the end of said finger, to maintain engagement with the fine threaded screm, $f^{7}$. The latter is rotated through the gear, $f^{8}$, in mesh with a gear, $f^{*}$, the latter engaging in turn 18 with a gear, $f^{3}$, (Fig. 5) upon the head of pulley, $e$, so that, cluring rotation of the record cylinder by said prilley, the said serew, $f^{7}$, causes the travel of the nut, $f^{6}$, and the yoke carrier, $f$. with the stylus lengthwise
15 the record cylinder. When the end of the desired stylus travel has been reached, the sliding rest, $f^{3}$, which is preferably provider with a bearing tip or point of electrically conductive metal, is cansed to engage
20 with two contacts, $\because$, shown in diagram in Fig. 15 upon the tilting rest, $f^{4}$, and make an electric circuit including a sonrce of electromotive force, 1 , cnergizing the solenoisl. $f^{88}$. The armature of the latter is connected
25 to a lever $t^{3 x}$, to which is secured a cam, $f^{\prime \prime \prime}$, upon which the tilting rest, $f^{4}$, is nomally sinported in the full line position shown, Fig. 4. Encrgization of the solenoid $f^{\text {*x }}$ causes the withdrawal of the lever, fox , from
30 the full line position shown in Fig. 4 to that slown in dotted lines, resulting in raising the tilting rest, $f^{4}$, and the ann, $f^{2}$, and the consequent withirawal of the mit fo fiom engagement with the serew, $f^{7}$, the pin 35 or tooth, $f^{11}$, atso carried by the finger, $f^{\prime \prime}$, inmediately therenpon entering into engagement with the coarser threaded, reverse, feeding screw, $f^{12}$, rotated in a reverse direction from the screw, $f^{7}$, by the gears, $f^{13}$

I have herein atso provided means simul- rying mechanism for changing or shifting the records to permit antomatically the pressmation of a new record to the shys and the repetition of the previonsty ileseribed movement of the batter with referene (o) the fresh record. To this and suitable locking devices are provided for locking the c:arriers against movement during the ome ward tavel of the styhas, for releasing the cartrated and for again locking the vimpors when a suceeding reeord has been brought into alimement with the driving me hanisim. When the slithere rest, flakes the diment which reverses the movement of the stybles. it alson (fferets conergization of the solemoile ! \% (Figs. 9 and 15), which opromas torock the lewer, $g^{\prime}$, abome its fiblemin al, $夕^{2}$, the cond of the lewer $g^{\prime}$, being provided with :1 yoke ! !". having stads cherging a groone in the col-
lar, $e^{4}$, whereby energization of the solenoid moves the collar, $e^{4}$, to withdraw the pin, $e^{2}$, from the recess in the cylinder spindle, $c$. The sprockets, $b b$, and the carriers would now be free to move under the influence of
the spring. $b^{2}$, were it not for the additional locking and locating device, h. (Figs. 9 and 14). comprising a pin shaped similarly to the pin, $e^{2}$, for entering the recess in the cylinder spindle and so located within a pocket on the frame, $A$, as to engage with the cylinder next adjacent the one in operative position. The locking or locating pin, $h$, is adapted to be thrown into or out of engagement with the cylinder spindle through morement of the piroted frame, $h^{\prime}$. yieldably comected to the head of the rod $h$ throngh the sliding and downwardly spring pressed pin, $h^{2}$. The head, $h^{3}$, of the pin, $h^{2}$, contacts with a cam shaped end of the arm, $h^{4}$, adapted to be rocked about its fulcrim, $h^{5}$, through the link, $h^{6}$, connected to the rocking lever', $g^{\prime}$. When the latter is moved by the solenoid, $g$, to withdraw the rod, $c^{2}$. from the spindle, $c$, and release the sime, the lever, $h^{4}$, is also thrown laterally, and rightlandedly as viewed in Fig. 1t, to rock the frame, $h^{\prime}$, about its fulcrim and throw the rocl. h, hackwatly out of engagement with its previonsly engaged spindle, the springpressed head, $h^{3}$, of the pin, $h^{2}$, yielding to permit the cam ent of the lever. $h^{4}$, to smap by the same into a position of rest. Bro this morement the record carriers are wholli. released. and the sprockets sint to rewore to move a fresh reard into position. During the succeeding movement. howerer: tha lomating device $h$, is spring-presed again-1 the onter faces of the chain links as the late ter pass before the same. immediately shapping inte the recess of the mext spintle ns the latler comes into alinement therewith. locating the new position of the remod (anriers and prevonting finther movement thereof. As semen :te the solmoid. !/ is de energized by the withdrawal of the shather rest. $f^{\prime}$, firom the contand pieses mon the dilling mes. the pill. ". will also cinter the rexes of the spindle now in uperative por-1
 with the stybs when the hatter has heron in tmonel to its initial porition. On tho de (Incryization of the -

 landed to it: nombal poritton iss -hom" in rig. 11.



 ment of the -prodere will tahe place ment perhing the fill meromedt beresary to
 before the sombl bes mbill the sliding reat
hare traveled far enough on reverse movement to break the electric circuit and deenergize the solenoid, $g$, thereby to free the drive shaft, $e^{2}$, for reëntering the next spindle recess. The provision of the locating device, $h$, however, makes the relative movements of the carriers and the sound box immaterial, since the pin, $h$, is always in position after the carrier movement has once
10 begun, to stop such morement at the proper time.

When the stylus reaches its initial position the sliding rest, $f^{3}$, is caused to make a circuit through a third solenoid, $f^{15}$, (Figs. 4 and 10), calusung the return of the cam, lowering of the tilting rest, $f^{4}$, thus throwing the nut, $f^{6}$, again into engagement with the fine feed screw, $f^{7}$, and repeating the
20 outward travel of the stylus with the fresh cylinder.

Referting to Figs. 16 to 22, I have there shown one form of my improved sound box which I preferably employ. The sound the brucheserably slid and frictionally held the tubular portions. $j^{\prime}$, and, $h^{\prime}$, of the sound box. The latter is provided with a double set of recording and reproducing devices, and I have herein shown those of one set as substantially duplicated by those of the other set. This, it is to be understood however, is not essential to my invention as the diaphragm certain purposes be widely different. The sound box consists generally of a double head or casing, $i^{\prime}$, and when in use is adapted to be frictionally held within the suitably haped double yoke, $f$, already referred to.
The casing, $i^{\prime}$, is provided with two cylindrical portions, $i^{2}$, and, $i^{3}$, that shown in. $i^{3}$, for example (see Fig. 20), being provided with a diaphragm, $x^{2}$, placed being material, such as rubber, and held against a shoulder in the casing by means of the back-piece. $7_{2}{ }^{3}$, screwed into the back of the casing $i^{\prime}$, against the preferably me-
 tion. $k^{\prime}$, of the back-piece, $k^{3}$, and preferably axially alined therewith and with the diaphragn, $l_{i}{ }^{2}$, I have provided the throat, l.". preferably threaded or otherwise contively to the face of the diaphragm, the end of the throat adjacent the diaphragn being suitably shaped for the most efficient effect, as by beveling the same, in the manner shown.
I hare found that it is not only desirable to have the sound orifice of each throat adjustable relatively to the diaphragm, but that each particular class of sound requires a special sound orifice for its most effective a special sound orifice for its most effective
reproduction. For example I have found that the full harmony of a brass band will usually be best developed through the employment of a throat having the general form of that shown in Figs. 20 and 21, while the note of a violin is more faithfully reproduced by a differently shaped throat, as for example, that shown in section in Fig. 22. The provision of a plurality of such throats, each proportioned or formed with respect to a particular quality of sound, in the reproduction of which it is intended to be used, and replaceable one by another, forms an important feature of my invention. Referring to Figs. 20 and 21, I have provided the slot, $k^{6}$, in the outer end of the throat member, which when the box is removed from the sound tube, may be conveniently engaged with a screw driver or other implement to adjust the mouth of the throat in any desired relative position to the diaphragm, or to remove the same entirely and replace it by another of different shape, size of proportion.

The two styluses are here employed, in 90 order to provide a multiple effect. the production of which, however, is obviously not limited to the use merely of two. Each of two styluses, $l$ and $m$, is connected to its respective diaphragn through the connecting body $l^{\prime}, m^{\prime}$, the links, $l^{x}$, and, $m^{x}$, and the rockshafts, $7^{2}, m^{2}$, so that, when in the operative position shown in Fig. 1 (see also Fig. 19), the point of the second stylus is caused to trail in the same record groove as the first stylus, but directly and immediately behind the latter, and also arranged so that the vibrations communicated to each stylus point are transmitted directly and efficiently to the corresponding diaphragin. The stylus points with their rockshafts are respectively supported and movable with the vibratable levers, $l^{3}$, and $m^{3}$, arranged side by side and hinoed at, $n$, (Figs. 18 and 20) to permit the individual and relative movement of the said levers to and from the surface of the record. the hinged support, $n$, being, however, itself swingingly mounted upon the stud, o, Fig. 18, to permit a slight lateral movement common to each stylus movement when such movement is requisite. Thus, althongh free ribration is permitted the stylus points in the reproduction of the intended sound, they are compelled always to track one after the other, and the lateral movement of one no matter from what cause mist be followed by a like movement of the other.
An equalized tension, tending normally to press the stylus points toward the face of the record, is maintained upon the tro stylus points by means of the lever, $p$, fulcrumed at, $p^{\prime}$, carrying the adjustable weight, $\mu^{2}$, the latter acting through the bar, $p^{3}$, equalizing rod, $p^{4}$, and pressure points, 130
$p^{5}, p^{6}$, engaging respectively or connected with the backs of the levers, $l^{3}$, and $m^{3}$. Thus, when the sound box is adjusted relatively to the record, and the stylus point or
5 points have found and entered the groove therein, the force pressing the same into the groove may be varied by adjustment of the weight, $p^{2}$, along the lever $p$; this force however, being distributed upon the two
10 points by means of the equalizing bar, $p^{4}$, thereby to maintain an individual tension npon each of the coöperating stylus points, such tension being proportioned to their individnal requirements and the movement of
15 one stylus point with its supporting lever in no way conflicting with simultanenus movement of the other point and its lever, whether such movements are similar or dissimilar. In order to relieve the diaphragm
20 and its connections from the weight of the stylus parts, including the weight, $p^{2}$, when the sound box has been lifted or withdrawn from the face of the record, I have provided the supporting pin with a cone-shaperd en-
25 larged head, $p^{8}$, against which the snitably formed ends of the levers, $m^{3}$, and, $n^{3}$. rest when the stylus points are withdrawn from the record, but so located as to permit free vibration of the said levers, under the in-
30 fluence of the record, when the points are in contact therewith and moved under the influence of the record groove therein. The peculiar cone shaped head of the face, $b^{8}$, and the correspondingly formerl walls upon
35 the two levers, permit repeated withdrawals of the points from the record groove with positive assurance, however, that the points will meet the record at exactly the same spot from which they were withdrawn, the ing undergone no relative movement.

I have found that the arrangement shown of multiple diaphragms, where they are grouped or clustered about a cominon posianism is directed, provides a highly effecient, and in fact so far as I am aware the only practical, construction for obtaining a multiple effect. I have also foumd that the ef0 fectiveness of the machine is greatly increased by the inter-comection which exists between the vibration parts of each system through which there is mantained a constant tundency for the styhns points and diaphagems to move in conjunction and rooperation, each one with the ofter or others.

It will be mulerstood that my insention is susceptible of embodiment in a grent varicty of forms and may be combined in vurions ways which I hate mot here attemptad to illustrate, sime the same are indoded within the serope of my invention us sod forth.

Claims.

1. A imultiple record phonograph linving
a plurality of record supports adapted each to travel to bring its record into and out of operative relation to the machine, and means for rotating a record placed in operative position, said means being adapted for engagement with or disengagement from said successive records, said record supports being each individually detachable from its connection with the machine at one point to permit the withdrawal of its record while still maintaining connection with the machine at another point or points.
2. A multiple record phonograph having record rotating means, and a plurality of record supports, the records carried thereby being adapted for successive engagement with the rotating means, the record supports being individually movable about their points of attachment to the machine to permit the removal of their records when disengaged from the said rotating means.
3. A multiple record phonograph having a plurality of record holding members swingingly supported upon a common carrying device.
4. A multiple record phonograph having a linked carrier and a plurality of record holding members swingingly supported upon the links thereof.
5. A multiple record phonograph having 95 a traveling carrier, a plurality of record supports attached each to said carrier at a plurality of points, record rotating means, means for moving said carrier to bring a record into operative position and for bring- 100 ing the same into engagement with said rotating means, means for disengaging the record from said rotating means and moving said carrier to bring a fresh record into operative position, and an axially vieldable105 comection at one of the points of attachment of each record support to its carrier to permit withdrawal of a record when out. of operative position.
6. A multiple record phonograph having 110 a movable record carrice for carrying a plitrality of records, satich reords having each a body movement with the carrier, a motary movement mpon its axis, and a swinging movement ahont a point of attachment to the carrier.
7. A somed reproducing or somme recording machine having a swingingly monnted record support, weord monting means therefor, and means for clutching said rotating 120 means to and machatching the samb from sald swinging support.
8. In a somad reprodurine and sombl re cording madine, a rotary swinginglymonted, recorl supporting pindle mand rotating means. mad a chuthing derico adapted to intertock "ith the emit of satid spindte atul eomed the same to satid rot tating memins.
9. Th in sombl reproducing and sommel re- 130
cording machine, a rotary hinged recordsupport, record rotating means, and means for connecting said rotating means to, and disconnecting the same from the hinged end 5 of said support.
10. In a moultiple record phonograph a plurality of record supports, a linked carrying member, said supports being attached each to a link of said carrier by a hinged 10 connection.
11. A multiple record phonograph haring a plurality of linked record carrying members, and a plurality of record supports. said record supports being attached to the 15 links of said carriers by a hinged connection at one end and a yieldable connection at the other end.
12. A multiple record phonograph haring a plurality of record supports, linked carying means therefor, and a toothed sprocket orer which said linked carrring means travels. said carrring means having a plurality of links adapted to engage each at its opposite ends with the teeth of said
25 sprocket and providing an intermediate point of attachment for the record support.
13. A multiple record phonograph haring a plurality of record supports, a linked carring member therefor. a toothed plurality of links ado plurality of links adapted each to engage teeth, and means for attaching said supports to said links.
14. A multiple record phonograph having a plurality of supports, a linked carrring member to which said supports are individually and remorably attached, and a releasing member for each of said supports record to release said support from the carrying member and permit the removal of its record.
15. A multiple record phonograph haring a plurality of record supports. carrying means therefor comprising a pair of linked carrying members between which records are carried. and guiding means for each of said linked carriers, the opposite
50 links to which said record supports are attached engaging each with said record guiding means at their opposite ends.
16. A multiple phonograph haring a plurality of record supports. carrying means
55 therefor comprising a plurality of linked carriers, and means between the records caraied thereby connecting said carricrs.
17. A multiple record phonograph haring a plurality of record supports, carring articulated caxjers between which the record supports are carried, and means to permit individual remoral of the records from their supports.
18. In a sound-reproducing or sound-
recording machine employing a plurality of records. the combination of flexible record carrying means supporting said records at each end thereof and means for permitting withdra wal of an individual record.
19. A multiple-record machine of the class described having carrier guiding means, and Hexible record-carring means the indiridual record-carrying units of which are in interlocking engagement with carrier guiding means at a plurality of points.
20. A multiple-record machine of the class described haring flexible carrier-means, comprising coöperating carrier-members to which the records are journaled and by which they are caused to travel to and from their operative positions, and stiffening means between said members and intermediate the records carried thereby.
21. In a derice of the class described, a plurality of record-carrving chains, guiding means for each. and guide engaging means comnecting the said chains intermediate the records.
22. In a sound-reproducing or sound-recording derice, the combination with flexible record-carrying means for supporting the record at each end thereof, of means for giving the record, when in operatire position. an extended rigid lateral support on either side of the axis thereof.
23. A sound-reproducing or sound-recording device having flexible record-carrying means employing an arched carrying unit.
24. In an apparatus of the class described employing a plurality of records, the combination with electromotive derices and means automatically to act upon said electromotive derices on the completion of one record to bring a succeeding record into operative position.
25. In an apparatus of the class clescribed employing a plurality of records, the combination with means automatically to adrance the records one by one to playing position, electromotive devices, and ineans automatically to act upon said electromotive derices to cause the restoration of the recording and reproducing mechanism to its initial position on completion of its travel throughout a record.
26. In an apparatus of the class described. the combination with a plurality of records of electrically controlled recordchanging means therefor.
${ }_{27}$. In an apparatus of the class described. the combination with a plurality of records. means for automaticaliy adrancing said records to present them one by one to the sound reproducing mechanism, and electrically controlled means for returning the reproducing or recording mechanism to its initial position.
27. In an apparatus of the class described employing a plurality of records the combi-
nation with means for presenting the records in succession to the sound reproducing mechanism, means for restoring the reproducing mechanism to its initial position on comple-
5 tion of its travel throughout a record, of electromotive devices for actuating said means, and circuit changing means carried by the reproducing mechanism for setting in operation said electromotive devices.
28. In an apparatus of the class described employing a plurality of sound records, means automatically to bring the records into and out of operative position, means
automatically to restore the reproducing mechanism to its initial position upon each change of record, and electrical contact means carried by the reproducing mechanism for setting in operation said record changing means.

In testimony whereof, I have signed my 20 name to this specification, in the presence of two subscribing witnesses.

GEORGE H. UNDERHILL.
Witnesses:
Raiph C. Powell,
Horace A. Crossman.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

## I. KITSEE.

PRODUCING PHONOGRAPHIO RECORDS
990,144.

aPPLIOATICN FILED MAY 23, 1907. BENEWED JAN. 6, 1911



WITNESSES: Goirh R © Gieayl

INVENTOR


# UNITED STATES PATENT OFFICE． 

ISIDOR KITSEE，OF PHILADELPHIA，PENNSYLVANIA．
PRODUCING PHONOGRAPHIC RECORDS．

## 990，144．

Specification of Letters Patent．Patented Ap⿳亠丷厂阝．18， 1911.
Application filed May 23，1907，Serial No．375，234．Renewed January 6，1911．Serial No．601，242．

To all whom it may concern：
Be it known that I，Isidor Kitsee．a citi－ zen of the United States，residing at Phila－ delphia，in the county of Philadelphia and
5 State of Pennsylvania，have invented cer－ tain new and useful Improvements in Pro－ ducing Phonographic Records，of which the following is a specification．

My invention relates to an improvement 10 in means for producing phonographic records．

One of the objects of the invention is，to produce a record without actual contact be－ tween the means actuated by the vibrating
15 diaphragm and the material on which the record is produced．

A second of the objects is to produce a recording device provided with means to adjust the same for the purpose of enlarg－
20 ing or reducing the undulating recording lines．

The drawing illustrates in perspective view a recording device embodying my in－ vention．
25 In this device， 10 is the sound collector and 9 the vibrating diaphragm．The re－ cording means are here illustrated as the siphon 1 dipping with one terminal into the liquid 6，the other terminal being in juxta－
30 position to the plate adapted to have re－ corded thereon the record．The means to suspend the siphon 1 are here illnstrated as consisting of the horizontal thread 5 se－ cured to the uprights 4，4．To this thread
35 is secured the plate 3 and on this plate is the tube 2．One of the legs of the siphon is carried through this tube．The plate 3 is connected through the rod 8 with the vibrat－ ing disk 9.
The operation of this device is as follows： The disk 7 is rotated at the required speed through one of the speed－mechanisms nsu－ ally employed in the production of phono－ graphic records．The siphon 1 is then
45 placed into the tube 2．If it is desired that the mudulations should be of great ampli－ tude，then the whole length of one of the legs of the siphon shall be drawn thromern the tube，and if it is desired that the modulu－
50 tions shonld be of lesser ：mplitude，then the siphon should be drawn upward，so that only part of one leg shall prot rude from the tube 2．To prodnce records，of which part of the lines should be of large and part of 55 the lines of small momplitude，it is only neres－ sary that the person in churge slomid，dur－
ing the time that the sound waves are im－ pinged on the vibrating diaphragm，raise or lower the siphon．The liquid 6 will，as is well undertsood，rise in one leg of the siphon 60 and will issue from the other leg．This liquid may consist either of a dark liquid． such as ink，or may consist of an etching fluid，or an etching－resisting fluid．Such in broad outlines are the means for producing records and the means for changing the am－ plitude of these records at the will of the operator，without necessitating the chang－ ing of the means to produce the air－wares．

Having now described my invention，what 70 I claim as new and desire to secure by Let－ ters Patent is：－

1．In a phonographic recorder，a vihrat－ ing diaphragm，recording unans，means for yieldingly suspending said recording means independently of the diaphragm．means to permit the position of the recording means to be varied relatively to the suspending means，whereby the amplitude of the un－ dulations may be varied，and means to con－ 80 nect said suspending means to the dia－ phragin．

2．In a phonographic recorder．a vibuat－ ing diaphragm，a recorder proper associated therewith，means for vieldingly suspending the recorder proper indenendently of the vibrating diaphragm，means for thansmit－ ting the vibrations of said diaphragm to said recorder proper，and a mounting for the recorder proper to permit the position 9 of the recorder proper to he varied in telal－ tion to said suspending means，whereby to increase or deerease the amplitude of the recorded lines．

3．In a phonographice recorder，a vibut－ 9 ing diaphragm，a recorder proper associalded therewith，me：ns for yieldingly suspending the recorder proper independently of thio vibrating diaphragm，me：ans for irmsmit－ ting the viluations of said diaphragm（10 100 said remoder proper，and a combedion be－ tween the recorder proper and salid sinspend－ ing means，wherehy the pasition of the re－ corder proper may the shifod matively（o） salid suspending means to inceraso or da 105 crease the amplitude of the merorded limes．

4．In at phonographic meoder，of vibut－
 therewith，means for vidhangly sinspemhing the recorder proper indapemidenty of tha vibrating diuphragm，mome for iramsmit ting the ribrations of suid dimphragm th
said recorder proper, and means for slidably mounting the recorder proper upon the suspending means, wherebr the position of the recorder proper may be raried in re-
5 lation to said suspending means to rart the amplitude of the recorded lines.

5 . In a phonographic recorder: a ribrating diaphragm. a siphon. means for suspending said siphon independently of the gm, a connection between said sus pending means and said diaphragnm. and means to permit the position of said siphon relatively to said suspending means to be changed, whereby to rary the amplitude of 1o the recorded lines.
6. In a phonographic recorder, a ribrating diaphragm. a siphon, a support for said siphon rieldingly mounted independently of the diaphragm. a connection between said support and said diaphragm, and means to permit the position of said siphon relatirely to said suspending means to be changed, wherebr to rary the amplitude of the recorded lines.

In testimont whereof I affix my signa- 25 ture in presence of two witnesses.

ISIDOR KITSEE.
Mitnesses:
Mary C. Samth,
Edith R. Stilley.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."
T. H. MACDONALD.

SHAVING MACHINE FOR SOUND RECORDS.
APPLIOATION FILED MAY 11, 1909.
990,366.
Patented Apr. 25, 1911.


## UNITED STATES PATENT OFFICE.

## THOMAS H. MACDONALD, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR TO AMIERICAN GRAPHOPHONE COMPANY, OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF WEST VIRGINIA.

SHAVING-MACHINE FOR SOUND-RECORDS.
$990,366$.
Specification of Letters Patent. Patented Apr. 25, 1911. Application filed May 11, 1909. Serial No. 495,283.

To all whom it may concern:
Be it known that I, Thomas H. Macdonald, a citizen of the United States of America, and a resident of Bridgeport, Con-
5 necticut, have invented a new and useful Improvement in Shaving-Machines for Sound-Records, which improvement is fully set forth in the following specification.
My invention relates to certain improve-
10 ments in graphophone and phonograph shaving-machines, intended for shaving off the surface of a cylindrical sound-record in order to obtain a smooth surface for use in further recording.
15 The apparatus is especially useful in connection with so-called "dictaphones" or machines for dictation purposcs.

Onc object of the invention is to enable the operator to obtain a very minute and
20 accurate adjustment of the shaving-knife, even while the machine is running, whereby sufficient material will be removed from the cylinder, but no more material than is necessary. By this economy in the material
25 shaved off, the cylinder can be shaved and used a greater number of times. The result of my invention is to prolong the lifetime of a dictation-blank.

Another object of the invention is to
30 prevent clogging of the knife by chips or shavings.

My invention consists of the novel construction and arrangenent of parts for accomplishing the foregoing, and further of
35 certain details hereinafter set forth and claimed.
The invention will best be understood by reference to the accompanying drawings, in which-
40 Fignre 1 is an end view, partly broken away, of the parts of a shaving-machine containing my invention; Fig. 2 is a detail, showing the knife-hokder carrying the shaving-knife and mounted in the knife-lan,
45 the view being from the divection 11 of Fig. of F Fig. ? is a side viow of F゙ig. "? Fig. 4 is a plan of the knife-holder and knife; Fig. 5 , is a front view of the knifebar, showing the diagonal position of the
50 knife; and Fig. $f$ is a dingram to indicate the direction of the operation.
Referring to the drawings, 1 is a purtion of the bed or base-plate of a shating-machine, which in its momentary fombures is
55 constructed on the usinal lines.

2 is the feed-screw which propels the carriage 3 longitudinally, parallel with the revonible mandrel 4.

5 represents a cylindrical sound-record, placed upon the mandrel in order to be shaved. The carriage 3 has a transverse horizontal bore, countersunk at its rear to provide the shoulder 6. Adjacent to the countersink is a screw-threaded seat 7 , parallel to the bore in the carriage. $S$ is the knife-bar, having a head 9 at its rear. A lateral projection from this head is apertured to receive freely the shank of the ad-justing-screw 10 , which screws into threaded seat 7, and has a shoulder bearing against the projection of head 9 .

11 is a coil spring, seated in the countersink, and encircling the bar 8; it bears against shoulder 6 and head 9 , and tends to force the bar rearward, away from the cyl- 7 inder 5.

In practice, the head of the adjustingscrew is made comparatively large (say an inch and a quarter in diameter), and the thread of the screw is comparatively finc (say forty threads to the inch), in order to permit very delicate longit udinal adjustment of the knife-bar s abainst the spring 11. The shaving-knife is carried by the forward end of knife-bar 8 , which latter may be provided with a shaving-box.

The forward end of the knife-har is slotted lomitudinally, the slot preforably ertending in a diagonal direction (as seem in Fig. it), to reselve the knife-holder. 12 is this knife-holder, a wentagmare plate of hasass. At its rean is a motelo 13; a mommo is milled ont at its forward end, leavime on each side wings it -11; aml near its fromt end is provided the hole $1 \therefore$.

If is the haife. prefinahls al slath of capphate, whing proferah? is powided with "1
 seren in ligig. A. 'The Fhife 16 is inserted ber fwern winge 1.1 11, which wre thill foreal
 and :hellan 15 is applied lo malo it mure se
 sorted in Itw (diagomal) = Fow in the formard "omb of hat s. "how it lit smely: amb 110


 on workel in its dingomul plate. There is a

the notch 13 at the rear of holder 12 : and opposite this notch is prorided a notch 20 . By placing the blade of a screw-driver in hole 19. so that one edge thereof enter: 5 notcl 13 and the other edge enters notch 20, the knife-holder and knife can be rocked on screw 18 as a pirot. by turning the screwdriver axially. This operation adjusts the position of the knife-edge with respect to
10 the surface of cylinder 5. And this rockingadjustment can be effected without stopping the apparatus.

21 is the shaving-box carried on the forward end of bar 8. It is shown as a long
15 narrow box extending vertically below the knife-bar. This bar 8 enters through the rear wall of box 21 , and the edge of the knife 16 protrudes slightly throngh an aperture in the front wall. which at this point is slightly aperture is enlarged, below the knife, sufficiently to let chips and shavings pass into the box. Preferably the top of the box may rest upon the bar $\mathcal{S}$, and a screw. as 22 . may
25 hold the box to the bar. The bottom of the box 21 may be left open, to discharge the shavings in a larger receptacle below.

The revolving mandrel 4 carries the cylinder 5 in the direction indicated by the arfor: so that the surface adjacent the knife 16 is traveling upward. In consequence, the chips or other material shaved off the cylinder 5 pass beneath knife 16, and drop into box 21 . On accomnt of the upward stress
35 upon knife 10, knife-bar 8 has its prime contact at the point 23 , and its secondary contact at the point marked 6,-in other words, the bar is jammed and held firmly in place. The pressure of spring 11 against head 9
40 tends to accentuate this; and the result of this rigid holding of the bar is to produce a more uniform cut and a smoother surface upon cylinder 5. But at the same time, the bar is readily adjustable longitudinally, to 45 and from the cylinder. and without stopping the operation of the shaving-machine.

Preferably the carriage is fed from the outer (smaller) end of the tapering mandrel, toward its inner (larger) end. In the ordmary recording and reproducing of sound the practice is to revolve the cylinder at a standard surface speed, but in shaving record-cylinders the machine can be run at a far higher speed; consequently there is
55 much greater stress upon the shaving-knife than upon a recorder or reproducer. In recording and in reproducing there is no particular advantage in propelling the stylus from the outer end of the cylinder rather than from its inner end: but if the knife of toward the outer or free end of the machine. there is a tendency to loosen the eylinder upon the tapered inandrel, with consequent
marked difference, resulting in a decided inprovement, in feeding the knife of a shar-ing-machine from the outer to the inner end of the cylinder.

I have described my invention with some 70 particularity but only for the sake of clearness, since modifications may be made in the construction of the parts and in their arrangement. without in any case departing from the spirit of my invention.

Haring thus described my invention, I claim:

1. A sharing-machine for cylindrical sound-records, comprising the combination with a revoluble mandrel for carrying a record-cylinder. and a carriage traveling parallel therewith, of a slaring-knife presenting a curred edge and pirotally mounted upon said carriage for presenting different portions of said curred edge to said 85 cylinder.
2. A sharing-machine for cylindrical sound-records, comprising the combination with a revoluble mandrel for carrying a record-cylinder, and a carriage traveling parallel therewith, of a sharing-knife lying in a diagonal plane and haring a curved edge and pivotally mounted upon said carriage for presenting different portions of said curved edge to said cylinder.
3. A sharing-machine for cylindrical sound-records, comprising the combination with a revoluble mandrel, and a carriage traveling parallel therewith, of a shavingknife mounted on said carriage and having its axis at right angles to said mandrel-axis and itself lying in a diagonal plane, and means for pirotally adjusting said knife in said diagonal plane while in operation.
t. A sharing-machine for cylindrical 105 sound-records, comprising the combination with a revoluble mandrel, and a carriage traveling parallel therewith, of a shavingknife mounted on sai.l carriage and haring its axis at right angles to said mandred-axis and itself lying in a diagonal plane, means for adjusting said knife longitudinally while in operation. and additional means for pirotally adjusting said knife in said diagonal plane while in operation.
\%. A sharing-machine for cylindrical sound-records, comprising the combination with a revoluble mandrel, and a carriage traveling parallel therewith, of a horizontal knife-bar mounted transversely upon said carriage and adjustable longitudinally thereof while in operation. and having a diag-onally-arranged longitudinal slot in its forward end, a knife-holder and knife pirotally seated in said slot. and means for adju:ting the same pirotally while in operation.
4. A shaving-machine for cyliudrical sound-records, comprising a tapering revoluble mandrel, and a sha ving-knife carried parallel with the axis of said mandrel and
operating solely in the direction from the smaller to the larger end thereof.
5. A shaving-machine for cylindrical sound-records, comprising the combination of a tapering revoluble mandrel, and a shav-ing-knife located adjacent that side of said mandrel which is rotating upward and traveling parallel with said mandrel and operating solely in the direction from the snaller to the larger end thereof.
6. A shaving-machine for cylindrical sound-records, comprising the combination with a revoluble mandrel, and a carriage traveling parallel therewith and provided
15 with a transverse bore and a transverse screw-threaded seat, of a headed knife-bar located in said bore and having at its forward end a diagonally-arranged longitudinal slot, a screw engaging said seat and the head of said bar respectively, and a shavingknife mounted pivotally in said slot.
7. A shaving-machine for cylindrical sound-records comprising the combination with a revoluble mandrel, and a carriage 5 traveling parallel therewith and provided with a transverse bore and a transverse
screw-threaded seat, of a headed knife-bar located in said bore and having at its forward end a diagonally-arranged slot, a screw engaging said seat and the head of said bar respectively, a shaving-knife mounted pivotally in said slot, and means for permitting adjustment of said knife upon said pivot while in operation.
8. A shaving-machine for cylindrical 35 sound-records, comprising the combination with a revoluble mandrel, and a carriage traveling parallel therewith, of a horizontal knife-bar mounted transversely upon said carriage and provided with a seat at its forward end, a knife pivotally mounted in said seat and provided with an exposed notch at its rear end, whereby said knife can be adjusted pivotally while in operation.

In testimony whereof I have signed this specification in the presence of two subscribing wituesses.

## THOMAS H. MACDONALD.

Witnesses:
A. B. Keough,
L. B. Nicifolson.

$$
7,2+1
$$

## R. L. GIBSON.

SOUND BOX FOR TALKING MACHINES.
APPIIOATION FILED NOV. 28, 1905.
990,973.
Patented May 2, 1911.


Fig. :


Fig. 4.


WITNESSES:
Wherathor, or


# UNITED STATES PATENT OFFICE. 

## ROBERT L. GIBSON, OF PHILADELPHIA, PENNSYLVANIA.

SOUND-BOX FOR TALKING-MACHINES.

## $090,9 \% 3$.

Specification of Letters Patent. Patented May 2, 1911.

Application filed November 28, 1905. Serial No. 289,410.

## To all whom it may concern:

Be it known that I, Romere I. (itbson, of the city and comnty of Philadelphia, State of Pennsylvania, have invented an Improve5 ment in somed-Boxes for Talking-Machines, of which the following is a specification.

My invention relates particularly to the means for supporting the stylus bar, and its object is to increase the sensitiveness and 10 volume of the somnds transmitted without decreasing their timbre and sharpness.

In another application, Serial No. 284,646, filed October 27 th, 1905, I have described a stylus bar support consisting of a spring
15 stincture arranged at right angles to the phane of the diaphragm of the sound box, and the present invention relates to a supporting device of this general character.

Nore particularly the present invention 20 relates to the employment in a supporting device of this kind of a leaf or Hat spring supported at its emds fransersely to the plane of the diaphragm and comected with the stylus bar between its ends, so that:

$$
25 \text { Wile great sensitiveness to direct vibration }
$$ in the plane of the diaphagm is preserved, the resistance to lateral or torsional movement is increased. fot only is the construction bencficial in inereasing the amplitudes

30 amb accuracy of the somed transmitted, but it is simple, cenomiaral and easily applied.

In the dranings: Figmre 1 is an elevation of a talking machine mbodying the invention ; Fig. $\underset{\text { e }}{ }$ is a front cheration of the somed
35 box; Fig. :3 is ant clevation of the "リner edge of the somul lux ; and l"ig. $t$ is a transverse sectional view on the lime $\mathrm{X}-\mathrm{X}$ of Fig. 2 rularged.

A is the rotaling weom anrying disk or
 sontal emberying arm; and 1) is the somat lone anspumbed from tha arm, with which it


Thite He partienlare emetruction of the pory-is mot matrefial for my invention, I have, lim jumpuses of illastration, slown": somed box of the gemeral chantatere shown in

50 Hth, 1s:9!, in which Hoe diaphagen is is "lamped bewwentlexible ringes F" will int He head Ex of the summ lowe and Hex dil




in the usual manner and is provided at the other end with a clamp K of any convenient construction. for holding the stylus or needle point.

The support for the stylus bar consists of a flat spring L . arranged transersely to the plane of the diaphragm and supported by the head. It is connected with the styms bar between its ends. In the construction shown, $M$ is a frame carried loy the heat of the sond box and having nothes $m m$ into which the ends of the spring I are sprimy, thereby curving the spring and pmtling it under tension. The bar J extents through the spring and frame MI and may be secmed to the former in :lny suitable manner. as by solder. With a spring support of this kind extending transversely to the plane of the diaphragm. and hence to the plane of vibration of the point of comection leetween the stylus bar and diaphragm the stylus har is made very sensitive fo the direct vibration, while lateral or torsional vibration is practically eliminated and this reevistance (1) lateral or torsional movement is gireatly inereased by the use of the flat spring. This. support. therefore by reason of its sensitiveness to direct ribration and of its resistance to lateral or torsional movernent tramsmits the sombl wares with greal amplitme and asemaer and not only incerases the volmone lint preserves the timbre and fone.

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diaphragm, and a stylus bar connected with the spring between the ends thereof, said spring having the function of a fulcrum and vieldingly supporting and holding said bar 5 in its normal position.
2. In a sound-box for talking machines, the combination of a head or case and diaphragm, a substantially rectangular flat spring bent transversely to its length so as
10 to be under tension and supported at its opposite ends only, said sole points of support and the spring being in a line transverse to the plane of the diaphragm, and a stylus bar connected with the spring between and in 15 line with the ends thereof, said spring having the function of a fulcrum and yieldingly supporting and holding said bar in its normal position.
3. In a sound-box for talking machines, the combination of a head or case and diaphragm, a supporting frame carried by the case having two oppositely directed shoulders, a substantialiy rectangular flat spring supported at its opposite ends only by the 25 shoulders of said frame, said sole points of support of the frame and the spring being in a line transverse to the plane of the diaphragm, and a stylus bar connected with the spring between the ends thereof, said
yieldingly supporting said bar in its normal position.
4. In a sound box for talking machines,
the combination of the head or case and diaphragm, of a transserse supporting 35 frame Mi carried by the head and arranged transversely to the plane of the diaphragm, the flat spring L having its ends sprung into engagement with said support and extending transtersely to the plane of the dia- 40 phragm and a stylus bar acting on the diaphragn and connected with said spring.
i. In a sound-box, a case having two supports arranged parallel to and at different distances from the diaphragm, a diaphragm located to one side of a plane through said supports, a flat spring sprung between the supports so as to be under tension and in a plane at right angles to the plane of the diaphragm, and a stylus secured to the spring intermediate of its ends and supported whelly by the spring and out of direct contact with the case.
5. In a sound box, the combination with a stylus, of a spring support therefor, and a spring supporting plate, the ends of said spring support being secured to the plate, and the central portion of said spring sup)port being sprung away from the said plate.
In testimony of which invention, I here- 60 unto set my hand.

ROBERT L. (x̀ BSON.

## Witnesses:

R. M. Kelly.
M. J. Eyre.

## C. A. RUMBLE.

ATTACHMENT FOR PHONOGRAPHS.
APPLIOATION FILED SEPT. $11,1906$.
991,090.
Patented May 2, 1911.
2 SHEETS-SHEET 1.



## UNITED STATES PATENT OFFICE.

# CHARLES A. RUMBLE, OF LOWVILLE, NEW YORK, ASSIGNOR TO AMERICAN GRAPHOPHONE COMPANY, OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF WEST VIRGINIA. 

# ATTACHMENT FOR PHONOGRAPHS. 

991,090.
Specification of Letters Patent. Patented May 2, 1911.

Application filed September 11, 1906. Serial No. 334,173.

## To all whom it may concern:

Be it known that I, Charles A. Rumble, a citizen of the United States. residing at Lowville, in the county of Lewis and State
5 of New York, have invented certain new and useful Improvements in Attachments for Phonograplis, \&e.: and I do declare the following to be a full. clear, and exact description of the invention, such as will
10 enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of 15 this specification.

This invention relates to new and nseful improvements in attachments to phonographs and graphophones, and especially in the provision of a means for comecting the reprodncer to the horn, and ntilized object of the invention is to produce a simple and efficient connection between the reproducer and horn holder and so arranged
25 that the connection may have a free movement corresponding to the movement of the reproducer.
My invention comprises varions details of constraction and inrangencuts of parts
30 which will be heremafter fully described and then specifically defined in the appended claims.

The inventive idea may be embodied in a variety of mechanical structures, some of
35 which, for the purpose of illustrating the invention, are shown in the accompanying dra wings, in which-

Fignre 1 is a perspective viow showing the mamer of attachment of my invention to a
40 talking machine. Fig. 2 is a vertical secetional view throngh the hom supporter and comuection betwen the same and the reprosducer. Fig. :3 is a perspective view of the horn suppert, the flexible tube for commec-
45 tion with the reproducer, and the tapering tone-arm which commets the horit surpore with the flexible tube, mud Fig. 4 is at sec tional view showing mother form of my invention.
50 Reference now lecing had to the demils of the drawings by fetter, A desigmates the cusing of an ordinary falking machine of the cylinder type, mid B is in bracked arm which is fnstened to the casing in wny sult-
55 nble mamer. The upper portion of suid
bracket arm has a curved shell C integral therewith, to the upper end of which a horn D is adapted to be fastened in such a manner that the horn will overhang the top of the case. The reproducer E has connected thereto a flexible pipe F , in the other end of which a tube G is fitted, being held in place by friction intermediate the two contact surfaces, and the opposite end of said tube $G$ has a free movement in the tapering end of the tone-arm $H$, the large end of which is inserted in the lower end of the shell C.
$\mathrm{C}^{\prime}$ designates a pivot pin projecting from the inner surface of the skell C adjacent to one of the openings therein, and the tonearm H has a perforation $\mathrm{H}^{\prime}$ adjacent to its enlarged end which enters the shell, which perforation is adapted to receive said pin $\mathrm{C}^{\prime}$ upon which it is adapted to have a miniversal pivotal movement.

In Fig. 4 of the drawings, I have shown another form of my invention, in which the tube $G$ is dispensed with and the small end of the tone-arm II is fitted within the flexible pipe $\mathrm{F}^{\text {and }}$ held from movement therein by frictional contact between the two ends, while the enlarged end of the tonearm If enters the lower opening in the shell and has a free movement therem, thms giving the tone-arm a universal movement incident to the movement of the reprodneer and dispensing with the pivotal comection, before described.

From the forequing, it will he seen hat a simple and efliciont comertion is attoreded between the reproducer and the horn-sinpporting bracket in a machine cmphying :
 that the (onc-nom mas be turnel in :my di-
 athords the free movement messary to combpensate for the variation in distance from the reproxheretylas to the point where the tome-anm is combeded th the harn. Noreover, hy this comstration the hom is shp porled in a position where it will not intro fore with the hamdting of the momed tw place it on and ofl the mandred, sens with the wemeal manipulat ion of the mathine.

What I duim is:-

1. In a talkiner machine, $n$ hambetmon seromed to the rasime of the mathine and poovided with al hollow shell to mencion a hom, a hollow tome arm intmected to said

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$\qquad$
hollow shell by a pin or lug formed on one of said members and entering a hole or opening in the other, a reproducer and telescopic connections between said reproducer and
aid tone-arm.
2. In a talking machine, a bracket-arm secured to the casing of the machine and provided with a hollow shell to receive the horn, a lug projecting from the inner wall of the shell adjacent to its lower end, a tapering tone-arm having an aperture in its wall adjacent to one end and adapted to receive said lug. an open-ended tube adapted to telescope with the contracted end of said a lug projecting from the inner wall of the shell adjacent to its lower end. a tone-arm having an aperture in its wall adjacent to its enlarged end and adapted to receive said lug, thereby affording a universal joint be5 tween said tone-arm and said shell, an openended tube adapted to be remorably held within the contracted end of the tone-arm, a reproducer and flexible connections between the same and said tone-arm.
3. it talking machine comprising a frame,
a mandrel on said frame, a record on said mandrel, a reproducer carriage mounted to more in a right line parallel with the axis of said mandrel, a reproducer supported by said carriage with its stylus in contact with said record, a tubular extension projecting from said reproducer, a fixed support, an amplifying horn mounted at its small end upon said support, and a hollow tone arm swingingly supported by said fixed support, communicating with said horn and having telescopic engagement with said tubular extension projecting from said reproducer.
4. In a talking machine, a sound record, a reproducer in operative engagement therewith, a tubular extension projecting from said reproducer, a fixed support, an amplifying horn mounted at its small end upon said support, a hollow tapering tone-arm siringingly supported by said fixed support at its larger end and communicating with said horn, and having sliding telescopic engagement with said tubular extension projecting from said reproducer.
In testimony whereof I hereunto affix my 55 signature in presence of tro שitnesses.

> CHARLES A. RUMBLE.

## Witnesses:

Charles S. Mereness,
Charles S. Mereness, Jr.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
$991.361$
A. N. PIERMAN.

PHONOGRAPH REPRODUOER,
991,361.
Patented May. 2, 1911.


# UNITED STATES PATENT OFFICE. 

# ALEXANDER N. PIERMAN, OF NEWARK, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY. 

# PHONOGRAPH-REPRODUCER. 

$991,361$.

Specification of Letters Patent. I'atented May 2, 1911. Application filed September 18, 1909. Serial No. 518,413.

## To all whom it may concern:

Be it known that I. Alexander N. Pierman, a citizen of the T'nited States. and a resident of Newark, in the county of Essex
5 and State of New Jersey, hare invented certain new and useful Improvements in Phonograph-Reproducers, of which the following is a description.

My invention relates to phonograph re10 producers of the pneumatic type, or, gencrally speaking, of the type in which undulations corresponding to sound waves are impressed upon a current of any suitable moving fluid by the operation of a suitable
15 valve throngh which the flnid is allowed or cansed to pass, the valve being operated in accordance with the somnd wayes as by connection with a reproducing stylus tracking a record groove.

The object of my invention is to improve the quality of sound reproduction of a device of this character by the production of a novel ralve stricture, the valve being extremely thin, very flexible, and of incon-
25 siderable weight, so that deferts due to momentum and inertia of parts are avoided and a more faithful reproduction obtained.

Other oljeets of my invention are the construction of parts and combinations of ele-
30 ments necessary or desirable for the attainment of the aboye mentioned object, as more particularly pointed out in the following specification and claimed in the appended claims.

Reference is hereby made to the accompalying drawings forming part of this specification, illustrating a preferred embodiment of my invention, in which-

Figure 1 is a contral vertical section 40 throngh a phonograph reproducer emborlying my invention, celtain parts being shonv in side elemation: and Fig. 2 is a plan viens of the port plate with the valse moment theren and evering the port.

Referring to the (latwings, the sombltor 1 maly be formed with (wo) chmmbers is commmicating theong the port! in the port plate $\overline{\text { a }}$, air being conducted into tha "hambere 3 ly means of a combuit of and es.
50 caning from the amomber ethrongh flo reproducere weck 7. The chambere ? is clased hy the chasure 8 which is sempen in mantion "grainst a shombler formed in the "imondur wall of the chamber:? by membe of the ring

10 of the cylinder 11 which is screwed within the depending flange 12 formed integral with the reproducer neek 7. The port plate 5 is secured in position between the upper surface of cylinder 11 and gasket 13. which is forced into close contact with shoulder $1 t$ within flange 12 when members 11 and 12 are screwed together. The floating weight 15 is pivotally mounted at 16 to the block 17 which is mounted as by screw 18 on the lower surface of the depending flange 10 . The stylus lever 19 is pivotally mounted at 20 to the lugs 21 depending from the floating weight 15 and the said stylus lever is provided with stylus 22 , all of the above mentioned parts being eommon.

The port 4, which is preferably in the form of a lengthened slit as shown, is normally closed by means of the value member 23 seated mon the port plate a to cover the port 4. The valve member 23 is extremely thin, being preferably formed of any suitable shect metal rolled to a thickness of from one to two one-thonsand the of an inels. I have fomed it impossible to canse material of such excessive thimess to lie evenly upon a flat surface. siner the tentemey to sur or become deformed locally out of contact with the surface 11 poll which it is placed is muaroidable. Such a thin film or sheet can. howerer, be placed upon a contexly curwed surface and (ant be stowehed on held mader pressme form closely to the curved surface med fit arcolately ipon the s:me without deformat tion thromghent its whole areat. I have upplied this prine iple to the thin talse member of my present invention, and anm emabled theredy to make nise of a value member hat-
 cordingly, the port plate $\boldsymbol{5}$ is formed upon its \#prer surface wilh a mentarly comed
 (1):

 inw Mhory the diancter of the virele. The vinto membere es is uremed to the port phate




 the spring Dif sexmed to port phate it hy me

$\qquad$

758085909510010.5110
ployed to press upon this end of valve 23 and normally retain the same in position upon its seat. Spring 26 tends to counterbalance the pressure of the air or other fluid 5 admitted into chamber 3 from conduit 6, so that when the fluid is admitted the valve is raised slightly from its seat to allow a slight normal leak of the fluid from the port. Spring 26 also performs the function of terial of which ralre 23 is formed to curre or become distorted, and holds the same accurately in contact throughout its length with its curred seat. Talre 23 is connected by means of link 28 to the tail of stylus lever 19. Whereby the morements of stylus 22 in tracking the sound record to be reproduced are accurately reproduced by the vibration of valve 23 , the extent of the open-
20 ing of port 4 being raried according to undulations impressed upon the current of fluid moring through port 4 , these undulations corresponding faithfully with the undulations of the record groore being tracked by the stylus 22 .
In the construction shown, link 28 extends through a central orifice in ralve 23 and is connected thereto br the ball or upset end 29 on the top of link 28 . forming a one-way on. alloug is obrion 28 might be rigidly connected to ralre 23 if desired. With the construction shown, the morement of stylus 22 orer elerations in the sound record results in the depression the morement of strlus 22 in tracking depressions in the sound record permits the fluid pressure upon the lower surface of valre 23 to raise the same to the greatest ex-
40 tent permitted by ball 29.
It is obrious that, if desired, suction might be employed instead of compression for carrying the moring fluid through the sound box, in which case, curred surface 24 would be located upon the lower surface of plate 5 and valre 23 seated therempon. It is also obrious that, if desired, a plurality of ports 4 might be employed, each with its corresponding ralre 23.
50 Haring nor described my invention, What I claim and desire to protect by Letters Patent is as follows:

1. In a phonograph reproducer, the combination with a body containing chambers
55 communicating through a port, of a port plate in which said port is formed, a portion of one surface of said plate adjacent to an opening of said port being curred, an extremely thin ralve member of elastic ma-
60 terial seated snugly upon said curred surface and corering said port, and means for
ribrating said member to uncover the said port to a greater or less extent in accordance with sound ribrations, substantially as described.
2. In a phonograph reproducer, the combination of a port plate having a regularly curred surface and haring a port extending therethrough with one orifice thereof situated in said surface, and a ralre member seated upon said port and conforming closely to said surface, substantially as described.
3. In a phonograph reproducer, the combination with a body containing chambers communicating through a port. of a port plate in which said port is formed, a portion of one surface of said plate being regularly curred, one orifice of said port being situated in said curved surface, an extremely thin ralve member of elastic material seated upon said surface and conforming closely thereto when at rest, and corering said port, and means for flexing said member to uncover said port to a greater or less extent in accordance with sound ribrations, substantially as described.
4. In a phonograph reproducer, the combination with a body containing chambers communicating through a port, of a port plate in which said port is formed. a portion of one surface of said plate being regularly curved, one orifice of said port being situated in said curved surface, an extremely thin ralve member of elastic material seated upon said surface and conforming closely thereto when at rest, and corering said port, means for introducing fluid under pressure within one of said chambers, means tending to hold said ralve on its seat against the pressure of said fluid, and means for flexing said member to uncorer said port to a greater or less extent in accordance with sound vibrations, substantially as described.
$\check{5}$. In a phonograph reproducer, the combination of a port plate having one surface formed with a regularly curved portion and having a port extending therethrough with one orifice thereof situated in said curved surface, an extremely thin flexible valve member seated upon said port and conforming closely to said surface, means securing said member in position, and yielding means tending to hold said member on its seat, substantially as described.

This specification signed and witnessed 115 this 16th day of September 1909.

> ALEXANDER N. PIERMAN.

Witnesses:
Drer Sinith,
Join M. Canfield.
991.424

## C. P. CARTER

PHONOGRAPH REPRODUCER.

## APPLICATION FILED SEPT. 20,1909

991,424.
Patented May 2, 1911.


## UNITED STATES PATENT OFFICE.

CHARLES P. CARTER, OF KINGSTON, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

# PHONOGRAPH-REPRODUCER. 

 Application filed September 20, 1909. Serial No. 518,575.
## To all whom it may concern:

Be it known that I, Charles P. Carter, a citizen of the United States, and a resident of Kingston, in the county of Ulster and
5 State of New York, have invented certain new and useful Improvements in Phono-graph-Reproducers, of which the following is a description.
My invention relates to phonograph re-
10 producers of the Edison type in which a floating weight is pivoted to the body of the reproducer and the stylus is carried by a lever pivoterl to the floating weight and connected to a reproducer diaphragm or other
15 means for proflucing sound vibrations.
My invention has for its object the mounting of the said lever in such a way that the stylus shall be free to move up and down and also horizontally or laterally in order to follow the sound record groove faithfully. I mount the lever upon a horizontal pivot pin in such a manner that the stylus lever is free not only to rock about the said pin in a vertical plane in tracking the sound record
25 groove, but also to rock about the said pin in a horizontal plane and also to move bodily laterally upon the said pin in following the irregularities of the record groove. My construction also employs an clastic or spring 30 means for maintaining the stylus lever centrally in alinement with the record groove and for returning the lever to said position after deviation therefrom and for restraining its lateral movement upon the pivot pin. 35 Reference is hereby made to the accompanying drawings of which-

Fitgme 1 is a central vertical section of a phonograph reprodncer constrncted in accordance with my invention, certain parts
40 being shown in elevation. Fig. 2 is a bottom plam view of the same, certain parts being shown in section; and lrig. 3 is a detait view similar to Fig. 2 of a modified form of my device.
45 The reproduece shown comprises the nsinal body 1 within which the daphragn 2 is clamperd between gaskets 3 by menns of the nsunt clamping nut 4. The flonting weight ${ }^{5} 5$ is pivoted at $f$ to a block 7 having a shmak
308 threaded within the body 1 . The floating weight in the form of my invention shown in Figs. 1 and 2 is provided with a pair of doponding lugs 9 und 10 within which is se-
cured the horizontal pivot pin 11 upon which stylus lever 12 is mounted. Lever 12 carries 55 stylus 13 and is connected to diaphragm 2 by means of link 14 . Lever 12 is mounter upon pin 11 in such a way as to be free to pivot upon the same in a horizontal plane. I accomplish this by providing lever 60 12 with a bearing surface for pin 11 which closely fits the same only at a central longitudinal section of the lever 12. That is, the lever 12 is given as nearly as possible merely: a point contact upon pin 11 so that the lever is free to rock in a horizontal direction. This is accomplished by enlarging the lole in lever 12 throngh which pin 11 passes from the central section of the lever tow:ard the two sides of the lever, as is shown in Figs. 2 and 3 of the drawings. This enlargement of the hole results in giving the latter an elliptical or circular shape at the two openings of the orifice upon the sides of the lever. these openings being, of comrse greater in diameter than the pin 11, the diameter of the hole midway between the lwo sides of the lever, however, fitting the pin 11 closely so that lengthwise movement of lever 12 is preventer.

In the form of my invention shown in Fig. 2 the lug 10 is some distane to one side of lever 12, spiral spring 1:5 being coiled aromed pin 11 between hig 10 and the adjacent side of tever 12. A washer 16 may be interposed between spring 15 and lever 12. As shown, lever 12 mormally rests agramst hag 9, hat may move from suld position against the pressure of springe 15. If Jesired, it is of comse obvions that a epriner similar to 15 might be interposed on hoth sides of tever 12, but I do mot comsider this enastruetion desirable or memesary.

In the modification shown in l"ig. 3, a tenf springe 17 is nsed in place of the spiral spring. In this case lever 12 is momed as before nom pin 11, ant elongated wisher or shave 18 prefermbly being monnted 11 pom the extension of piin 11 to one side of lever 12. the end of leaf spring 17 being provided with mopening throngh which the end of pin 11 is passed, spring 16 thas bearing di Pertly upon the emt of strew is: If desired. it is. of connes, olvions that spring 10 might hear diredty nguint the side of hever 12 .

Huving now described my invention, what

I claim and desire to protect by Letters Patent is as follows:

1. In a sound reproducer, the combination of a body, a floating weight carried thereby,
5 a horizontal pin carried by the floating weight, a stylus lever pivoted upon said pin and free to move bodily thereon axially of the same. a stylus carried by said lever, said pin projecting to one side of said lever and 10 vielding means arranged to press against the side of said lever and resiliently resist lateral movement thereof upon said pin, substantially as described.
2. In a sound reproducer, the combinathereby, a horizontal pin carried by the floating weight, a stylus lever piroted upon said pin, a stylus carried by said lever. said lever being provided with an opening from po side through which said pin passes provided with a close fitting bearing surface for said pin at the section of said lever midway between the two side surfaces thereof only, and yielding means tending to maintain said lever in a central position, substantially as described.
3. In a sound reproducer, the combination of a stylus lever, a horizontally disposed pin upon which said lever is piroted said pin extending through said lever from side to side and being longer than the width of said lever and said lever being free to move laterally upon said pin, fixed means upon one side of said lever, and yielding means upon the other side of said lever, a rranged to restrain lateral movement of said lever upon said pin. substantially as described.
4. In a sound reproducer, the combination of a stylus lever. a horizontally disposed pin
upon which said lever is piroted said pin extending through said lever from side to side and being longer than the width of said lever, and said lerer being free to more laterally upon said pin, and yielding means laterally disposed to said lever arranged to restrain lateral movement of said lever upon said pin, substantially as clescribed.
5. In a sound reproducer, the combination of a stylus lever, a horizontally disposed pin upon which said lever is pivoted longer than the width of said lever, said lever being provided with an opening from side to side through which said pin passes haring a close fitting bearing surface for said pin at the section of said lever midway between the two side surfaces thereof only, and said lever being free to move bodily laterally upon said pin, substantially as described.
6. In a sound reproducer, the combination of a stylus lever. a horizontally disposed pin upon which said lever is pivoted longer than the width of said lever, said lever being provided with an opening from side to side through which said pin passes haring a close fitting bearing surface for said pin at the section of said lever midway between the two side surfaces thereof only, said lever being free to move laterally upon said pin. and yielding means arranged to press laterally upon said lever to restrain such movement, substantially as described.

This specification signed and witnessed this 17th day of Sept. 1909.

CHARLES P. CARTER.
Witnesses:
Jno. B. Alliger,
James J. O'Connor.

$$
49 \dot{2}, 029
$$

J. MORTON.

SOUND RECORDING AND REPRODUCING INSTROMENT.
APPLIOATION FILED FEB. 13, 1911.
992,029.
Patented May 9, 1911.


# UNITED STATES PATENT OFFICE. 

# JOSEPHINE MORTON, OF LONDON, ENGLAND, ASSIGNOR TO MELVIN WILLIAMS \& CO., LTD., OF CARDIFF, ENGLAND, A CORPORATION OF GREAT BRITAIN. 

SOUND RECORDING AND REPRODUCING INSTRUMENT.
992,029.
Specification of Letters Patent. Patented May 9, 1911. Application filed February 13, 1911. Serial No. 608,251.

## To all whom it may concern:

Be it known that I, Josepinne Morton, a subject of the King of Great Britain, residing at 33 Finrnival street, London, in the 5 county of Middlesex, England, have invented a new and useful Imprevement in or Relating to Sound Recording and Reproducing Instruments, of which the following is a specification.

This invention relates to sound recording and reproducing instruments such as gramophones, phonographs and the like, and it has more particular reference to the construction of the cabinets for containing the
15 entire mechanism, and which are provided with vertically arranged trumpets having their flared mouths directed toward fretwork covered sound openings in the casing. Instruments of the kind referred to usually
20 have one or more trumpets branching from the sound pipe vertically to the top of the inclosing cahinet ; said trumpet or trumpets being fitted at or near their ends with sounding boxes for the intensification and mel-
25 loving of the reproduction: or with bridge pieces near the mouth for transmitting the vibrations of the wider part of the trumpet to the casing withont the vibations of the narrower part affecting the strengthening
One feature of my invention is to provide an improved construction of gramo. phone or phonograph cabinet of the foreroing type which is fitted with a novel somed
35 diffuser or deflector.
A further feature of my invention consists in the particular method of forming and arranging the month of the trompet relative to its longitudinal axis or the sombl
40 pipe and inclosing cabluet wherely the somuds reproduced are much mote eflecedively diflused instead of being projected in onic or more definite amd distinct directions.

The acermpanying drawing is in illnstan-
45 tion of my invention, Figure I buing at front elevation, parly in sedion, of one combenient cmbodiment of the present improne ments; Fig. as is a central remtion sedion taken at right :anges to Figr. I, and Figy is is 60 :1 plan view.

Acomding to the illastrated way of carrying my invemtion into cflect I constrod an wontel! or ollow mitabla calined "rectangular in plan and of a sulficient deptls to
contain the sound recording and reproduc- 55 ing mechanism as well as the trumpet $b$, and provide it with a door or doors $c$ for giving access thercmito. In the drawing the mech-ani-m is arranged in a compartment $d$. below the record carier $e$, and $f$ is the somnd arm and connection to the trumpet $b$. This cabinet is provided with legs $g, g$, of any desired shape and height, or a stand may be used for supporting the cabinet, and for an appropriate depth from the upper edge 65 of the cabinet around three of its sides-for example-I form openings or sound apertures of any of the well known types. but preferably I fit these openings with fretwork or the like $h, h$. behind which I arrange fine silk to give a finished appearance to the entire cabinet.

Intemally of the cabinet a and extending vertically upward from the sound pipe $f$ I arrange the trumpet $b$ which may be of any desired (ross section and material, the upper edge of which is outwardly flared at one part ito the extreme upper edge of that side or back of the cabinct which is not furnished with an opening or sumbl aperture. The opposite side $j$ of the (rumper $b$ is correspondingly flared and joined to the lower elge of the fromt ome of the aforesaid openings or that opposite the back or blank side of the cabinet. The (wo other sides li, l. of the trumpet bate similarly flared and downwardly inclined in anoblique plane as shown in Fig. … from the higher to the lower sides abowe decribed, and it is also to be oberemed Hhat the tretwork $h$ is correpondingly inclined.

Oree the top of the cabinet ato and to prerent the ingrese ol dive ame dhat to the frompet. I Ilas arralnge a thin perforater cover or silk gata of ohme light matherial which does not interlere with the s mat reproduction. Above this gan\% eontring. and at : shant distamee therefonm, lime, pref.

 terial $m$ which comstitutes an sumbl ditlure
 fively in all directions. In the da: wing this dillinere $m$ is himeed at $1 /$ to an matandinge part of the bacde of the calbind at and it is
 Hm! I wi-h to here point ant that I :m full?

layers of wire gauze with an intervening layer of cotton wool have been applied to the sound gratings of instruments of the above type. openings and fretwork coverings $h, h$, and flare the trumpet all around to the upper edge of the cabinet, and inclose the spaces intervening between the sound diffuser $m$ and said upper edge by means of inclined strips of silk backed fret work, as indicated by the dot-and-dash lines $p, p$, in Fig. 1.

Obviously the upper edge of the trumpet $\zeta$ may be flared outwardly in various ways 15 to give a neat and artistic finish and I wish to point out that I do not restrict myself as regards its shape in plan, neither do I confine myself to a rectangular cross-section of the cabinet, or the particular contour of the sound diffuser $m$ shown and described.
From the foregoing it will be seen that by my invention I greatly improve the efficiency of gramophone, phonograph and the like cabinets, arranged in accordance therewith and that without adding in the least degree to the difficulty of construction,
whereas I effect a considerable reduction in the cost of manufacture.

What I claim as my invention and desire to secure by Letters Patent is:-

A gramophone or phonograph cabinet comprising a casing, an instrument and a trumpet therefor in the casing, the trumpet being arranged in a vertical position with its mouth in an inclined plane, fret-work forming the upper portion of the casing from the inclined plane of the mouth to a horizontal plane from the high point of the mouth of the trumpet, a covering of silk arranged above the end of and falling down below the fret-work to prevent ingress of dirt, and a hinged horizontal sound deflector of less width than the width of the casing arranged in contact with the top of said covering, substantially as described.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

## JOSEPHINE MORTON.

Witnesses:
Edtard Lacrence Herwood Elliott, John 0swald Farrer.

Coples of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."
$99.2,196$
J. R. CRAIG, JR.

GRAMOPHONE RECORD AND HOLDER FOR THE SAME.
APPLIOATION FILED MAY 28, 1910.
992,169.
Patented May 16, 1911.


Witnesses.
Q. 13 , Kaxymi
C.F. Early.


# UNITED STATES PATENT OFFICE. 

JOHN RICHARDSON CRAIG, JR., OF LONDON, ENGLAND, ASSIGNOR TO PHONOFILM SYNDICATE, OF LONDON, ENGLAND.

GRAMOPHONE-RECORD AND HOLDER FOR THE SAME.
992,169.
Specification of Letters Patent. Patented May 16, 1911. Application filed May 28, 1910. Serial No. 563,882.

To all whom it may concern:
Be it known that I, John Richardson Cratg, Jr., a subject of the King of Great Britain, residing at Gloncester Mansions,
5 Cambridge Circus, Charing Cross Road, London, England, have inventerl new ami useful Improvements in Ciramophone-Records and in Holders for the Same, of which the following is a specification.

It has before been proposed to ise for gramophone records, disks of some light thin and flexible material, such disks when in use being rigidly clamped around their edges onto a rigid plane surface.

According to this inveution an anmhes is employed in place of a disk and this annulus is loosely lield aromed its edge onto a more or less yielding backing.

Figure is a plan of the record; Fig. 2 is a plan and F'ig. 3 a section of the holder with the record in place; Fig. 4 is a plan and Fig. 5 is a section of a modified form of holder.

The holder consists of a disk a of card-

Figs. 4 and 5 the disk $a$ (which as lofore forms the backing for the record 6 and is preferably faced with blotting paper) is inserted into an anmilar frame of of thin sheet metal provided with a flange $d^{\prime}$ which prerents the recort of from escaping.

It is fomed that an amulas lies mucle flatter and is less liable to cookle than a disk and that the yiekling holding and lacking of it greatly diminishes the umpleasmint metallic somm common in gramophones.
The material which it is preferred to employ for the record is cellutoid and its thickness should be about that of stont papere its flexibility being such that while it is not mat erially deformed by its own woight it can nevertheless be bent by a rery slight pressure.

What I claim is:-

1. A gramophome recort, consisting soldy of an ammans of thin flexible peodedereiving material.
2. The combination of a thin thexible annulargranoplone record and a holder for the record consisting of a backing and means for secming onle ergee of the recold to holder.
3. The combination of a thin highty tlexible amman gramophome reowd and : holder therefor: comsistinge of : rimbling sombl-absombing smbtane amd a rine unplied to the witer alge of the howlen angrang the outer atige of the remeral.

Witnesses:
A.fmen Numas.


Copics of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
J. NOLL.

SOUND RECORDING APPARATUS.
APPLIOATION FILED JAN, 31, 1910.
993,542.
Patented May 30, 1911.

13.8 Yishburne
By Ch Rombin.

## J. NOLL.

SOUND RECORDING APPARATUS.
APPLICATION FILED JAN. 31, 1910.
993,542.

Patented May 30, 1911.
3 SHEETS-SHEET 2

WITNESSES
C M. Davies
8.PFushlinn...
Dy C.L. Pumben.
J. NOLL.

SOUND RECORDING APPARATUS.
APPLIOATION FILED JAN. 31, 1910.
993,542.
Patented May 30, 1911.
3 SHEETS-SHEET 3.


INVENTOR
Uohn Noll


# UNITED STATES PATENT OFFICE. 

JOHN NOLL, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF TO EUGENE DEL MIAR, OF NEW YORK, N. Y.

## SOUND-RECORDING APPARATUS.

993,542.
Specification of Letters Patent. Patented May 30, 1911. Application filed January 31, 1910. Serial No. 541,145.

To all whom it may concern:
Be it known that I, John Noll, citizen of the United States, residing at Brooklyn. in the county of Kings and State of New York, have invented certain new and nseful Improvements in Sound-Recording Apparatuses, of which the following is a specification.

This invention relates to sound recording 10 apparatus, and contemplates the provision of novel means embodying a telephone and a phonograph for producing phonographic records of dictated matter in a more accurate, convenient and economical manner is than has been heretofore possible.

Phonographs especially constructed for the purpose are extensively and successfully employed in offices and eisewhere for making records of dictated matter, which when Such use of phonographs is subject to certain marked disadvantages. In the first place, the operator mist provide a place nisually near his desk for a cumbersome machine
25 and for the cylinder, holders, and the like, and must provide electric enrrent or other means of operating the mechanism of the phonograph. He must attend to the provision of blank cylinders, guard them with ring surface mutilation, both before and after use on the phonograph, and gencrally look after them until they are placed on the reproducing machine. Furthermore, the 35 nser must attend to the placing of the rerords in the machine; he must adjust the styhus in position for work, and genemally give his personal attention and his time to the mechanical manipulation of the phonodista mechamism from the time he stats 10 dictate to it until the dietation is complete.

It is one of the important oljeets of this envention to overemothe above named disatvantages by wholly relieving the user of

A further object of the jurention is to
provide signal means to apprise the dictator when a cylinder is in position ready for nse, and to notify him when the record on the machine to which he is dictating, is completed, and when such record is replaced by a freslı cylinder.

Other objects and advantages will appear in the course of the following description, Wherein reference is made to the accompanying drawings, in which,

Figure 1 is a cross-sectional view showing several phonograph units and the driving means therefor. Fig. 2 is a side elevation of a single unit. Fig. 3 is a detail view of a coil operated clutch which I employ. Fig. 4 is a detail view of a slide rod for opening and closing the operative circuit. Fig. 5 is a detail sectional view showing the nagnetic recorder and associated parts. Fig. 6 is a detail view partly in section, of the transmitter standard and a signal lamp mounted thereon. Fig. 7 is a detail sectional view of the transmitter standard showing the switeh mechanism monnted therein, and Fig. $S$ is a diagrammatic view of the electrical features of my invention.

My invention essentially comprises a telephone transmitter 1 and :a receiver 2 , both being of the usnal construction. except that the diaphragm 3 of the receiver carries sentrally thercof, a stylus 4 adapted for contaet with the surface of a phonograph cylinder 5 , as shown. The receiver 2 , wherein are supported the magnets 6 , is pirotally supported from a pin or bolt 7 . by mems of an amm $7^{a}$ extending between eirss \& momnted upon a sleere ?, adapted for sliding movement alonge a supportinge gnide wod 10 .

The receiver being freely pivoted on the pin or bolt T, presses the stylns 1 nemanet the 95 cylimerer, as will be evident from Fig. 1.

A table or othere smitable sumport 11 is provided and suitubly sermed nponthis are the standards 19, $1: 3$ and 14 , these stmudurds beimer lisposed us cleaty indiated in Figs. 1 and !. Theme standaris support the gride rod 10 and a hollow rod or shene $\begin{aligned} & \text { an , in }\end{aligned}$ Which is momuted as shaft 16 , which is serewthremded for the errenter portion of its lemeth between the sumporting standads $1: 8$ and 14.
The shewe 10 is 0pert $n t$ its lower side as indiomed in lig.g. of lo permit the 11 m 17
 themeder at its frew end for oprotative com gngement with tho seremb theads ont the 110
shaft 10 to effect the morement of the receiver stylus longitudinally of the cylinder, as will be more fully explained. The arm 17 is piroted to a pin 18 passing through ears 5 19 supported by a sleere 20 , which is longitudinally morable upon the sleeve 15.

The sleeves 9 and 20 are bridged by the arms 21 and form therewith a suitable support for the receiver 2 .
The arm 17 is continued beyond the point of its pirotal comection with the rod or pin 18 to form a latch 22 , adapted for engagement with the free hooked end 23 of the arm 24 which is integral with the dependThe handle 25 is likewise integral with the depending arm $7^{\text {a }}$ for supporting the receiver 2 and with the arm 24 , and serves to more the receiver stylus into and out of engage-
20 ment with the cylinder 5 .
By reference to Fig. 5 of the drawing, it will be noted that when the handle 2.5 is manipulated to move the stylus 4 away from the cylinder 5 the hooked end 23 of the arm threaded end of the arm 17 out of encagement with the screw-threaded shaft 16 and also locking the receiver out of engagement with the cylinder 5.
The threaded shaft 16 is actuated by means of a spur gear 20 which engages a pinion 27 carried by the shaft 28 upon which is mounted the crlinder or form for receiving the phonograph cylinder. The shaft 28 morted by a suitable bearing in the standards 29 and 30 (see Fig. 3). The shaft 28 receives its motion through the medium of a worm gear 31 in engagement with threaded portions of the worm shaft 32 ,
40 which shaft is continuously driven by a motor 34 , connected by belt 35 with a pulley 36 , mounted upon the shaft 28 . The worm gear 31 is loosely mounted upon the shaft 28 and causes its rotation through the me-
 elements 37 and 38 , the former being secured to the worm gear 31, and the latter splined on the shaft 28 . A slot 39 in the clutch element 38 is engaged by a yoke 40 carried
50 at the free end of an arm 41 pivotally mounted upon a pin or bolt 42 secured within bracket 43, mounted upon the support 1. The free end of the piroted arm 41 terminates in an armature 44 , disposed adjacent core 45 of an electro-magnet 46 of sufficient strength to press the clutch element 38 against the teusion of spring 47 into operative engagement with the clutch element 37. It will thus be seen that when the elec-

80 tro-magnet 46 is energized, shaft 28 will be rotated by reason of its engagement with the worm shaft 32 and shaft 16 will be rotated by reason of the engagement of gear 26 with pinion 27.

It may be here stated that the motor 34
constitutes a portion of the motor generator designated by the reference numeral 50 , in Fig. 8 of the drawing. The motor which is supplied with any available current serves to operate the mechanism as hereinbefore described, and also to operate the generator to produce a low tension current, preferably of about twenty-four volts, to be used in the telephone circuit and for operating the signal mechanism to be hereinafter described, and for energizing the electro-magnet 46.

By reference to Fig. 4, it will be noted that the guide rod 10 is hollow and contains a slide rod 51 , having outstanding lugs 52 and 53 in position to be engaged by the sleeve 9 at the ends of its path of trarel, and to slide the rod a short distance in the direction of morement of the sleere 9 . The slide rod 51 carries a block of insulating material 54 in position to engage the curred end 55 of the contact spring 56 and press the same out of contact with contact spring 57 , as will be evident in Fig. 4 of the drawing. The contact springs 56 and 57 are supported by the upright 12 and insulated therefrom and from each other by the insulation 58.

It will be evident from Fig. 4 of the drawing, that when the sleeve 9 carrying the receiver 2 is mored to the right a distance sufficient to bring the stylus 4 nearly to the end of the cylinder 5 , the lug 53 wili be engaged by said sleeve and the slide rod 51 moved to the right a distance sufficient to bring the block 54 against the spring 50 to press the same out of engagement with the spring 57 , thereby opening the circuit between the springs 56 and 57 . The result accomplished by opening the circuit at this point will be hereinafter more fully explained.

By reference to Fig. 6, it will be seen that the standard 60 which carries the transmitter 1 is provided with an opening 61 at the top thereof through which extends a small incandescent signal lamp 62, supported in a socket comprising oppositely disposed springs 63 and $6 t$, through which a filament 65 of the lamp receives its current. The lamp is protected from injury by a skeleton guard comprising two metallic strips 66 and 67 secured at their ends to the top of a transmitter standard.

Supported within the transmitter standard and suitably insulated therefrom and from each other, as shown in Fig. 7 , are spring contacts 70 and 71 , normally out of contact with each other. Disposed adjacent the contact spring 70 is a third contact spring 72 , secured to the wall of the transmitter standard and in electrical contact Klerewitl. Opposite the contact spring 72, is an opening 73 in the side of the transmitter standard, throngh which projects a block of suitable insulating material 74 secured to the spring 72 and movable there-
with. As shown in Fig. 7 of the drawing, the parts are so disposed that pressure against the block 74 will bring the spring 72 into engagement with the spring 70 and will force 5 this spring into contact with the spring $\tau 1$. The block 74 protrudes through the opening 73 for a distance such that when the transmitter standard is grasped in the hand of a user, the springs 70,71 and 72 will be
10 brought into contact conveniently and without conscious effort upon the part of the user.

The circuits by which the various electrical features of the present invention are
15 connected will now be explained with reference to the diagrammatic view shown in Fig. 8. The motor generator 50 receives current from a suitable source of supply represented by the line wires 80 and 81 and
20 the generator produces a low tension current preferably of about 24 volts. Metal strips 82 and 83 are connected to the opposite sides of the generator. From a binding post 84 in electrical communication with
25 metal strips 83 , a line $84^{\prime}$ extends to binding post 85 between which and binding post 86 is interposed a suitable visual or other electrical signal 87 having a resistance of preferably about 100 ohms. The binding posts
3085 and 86 are connected respectively with contact springs 56 and 57 , as shown, so that when said springs are in contact, the current will pass from binding post 85 to 86 through such springs without traversing the signal
35 87. The binding post 86 is connected by line 88 with the electro-magnet 46, which magnet is energized only when the resistance of signal 87 is cut out of circuit by contact of springs 56 and 57 . From electro-maguet
4046 the line 89 leads to the lamp 63 in the liend of the transmitter standard, the other side of the lamp being connected by line 92 with the contact spring 70 within the telephone standard. When the springs 70 and
4571 are brought in contact by pressure upon the block 71 , the cirenit is completed through the springs 70,71 , the common rehurn wive 93 , to the metal strip) 82.
From binding post 94, in commmication
50 with the metal strip $8: 3$, a line 95 leads to the primary circuit 96 of an induction coil 97 and from there by way of line !s through the transmitter 1 and to the metal standard (6) with which the other side of the trans-

55 mitter is comected. When the springes oto, 71 and 72 are in contact, the cirenit is compheted from the standard tio through eonbacts 72,70 and 71 back to metal strip 82 by the common retmon wire !!3.
Bo The secondary cirenit $3 G^{n}$ of induction woil 97 is commeted as shown with the rewiver 2 , which admates the stylus 1 as will lie readily minderstomed.

In the preferred form of my invention, 05 the signal device 87 comprises a small vismal
signal located near operator's desk. This signal shows only when the contact between springs 56 and 57 is broken, which by reduction of current, darkens signal lamp 63, and it will be understood from the foregoing description that the springs 56 and 57 are in contact, until the sleeve 9 comes into contact with lug 53 and moves the slide rod 51 sufficiently to bring the block $5 \pm$ into engagement with the spring $\check{6}$. This occurs only when the phonograph cylinder has been entirely utilized, and a new cylinder is required. It will thus be seen that when the glow disappears from lamp 63, it indicates to the dictator that he must suspend dictation until the operator at the phonograph end of the line removes the record and supplies a new cylinder. When this is done, the sleeve 9 is moved into contact with lug 52 and the slide rod 51 moved to the left so that spring 56 again contacts with spring 57, whereupon the glow appears in signal lamp 63, and the dictator knows that a new cylinder is ready for his use. When the visual signal 87 appears, the operator 90 knows that a new cylinder is required.

In the description of my apparatus. I have referred to only a single unit, but it is obvious that any desired number of units may be provided in proximity to each other 95 and operated from a common source of power, as clearly indicated in Fig. 1.

White I have specifically described the preferred form of my invention, it is to be moderstood that numerous changes may be made in the form, proportions, and minor details of the parts. and that my invention is not limited to the specific embodiment of my invention illustrated, except as defined in the appended claims.

H:aving described my invention, I clam:

1. In apparatus of the character described, a transmitter, a phonograph comprising a stylns, electro-malguctic means actuated by the transmitter carrent for operating sald stylus, a rotatable support for a wax cylinder to be incised by said stylus, means adapted to be comected with salid rotatable smpport to elfect the rotation thereof, al magnetie cluteh adapted to connect said mems with sad motatable support to effect the rotation thereor) a switch, a resistance, an electric signal in cirent with the magnet of sald chatch, means to bridene said resistane to emt the satme ont of cirent. sabid wedric signal being adapted to indirate when satid resistume is cout out of eipanit, and nemus for chere the satid switch, sul). stantially as described.
2. In :1ppatatis of the matator de 125 seribed, of fransmither, a sigunl lamp nson riated therewith, a phomotaph comprising
 with sath transmitter, "phonogroph winder supported in proximity to sald stylns, 130
a support for said stylus longitudinally movable with reference to said cylinder support, a slide rod actuated by the longitudinal movement of said stylus support, springs 5 adapted to be thrown into and out of contact by the movement of said slide rod, said springs being in circuit with said signal lamp, a visual signal affording substantial resistance having its terminals electrically 10 connected with said contact springs to carry the current from one side of the circuit connected with said springs, to the other when said springs are out of contact, and means arranged near the signal lamp for closing 15 the said circuit, substantially as described.
3. In apparatus of the character described, a transmitter having a diaphragm, a receiver having a diaphragm, adapted to vibrate in correspondence with the trans-
20 mitter diaphragm. a stylus actuated by the said receiver, a phonograph cylinder support in proximity to said stylus, a continuously rotating shaft, a coil actuated clutch to connect the rotatable cylinder support
25 with said continuously rotating shaft to effect the rotation of the former means to effect the movement of the receiver longitudinally of the cylinder support, a circuit haring contacts adapted to be opened by 30 the said longitudinal movement of the receiver, a visual signal offering substantial resistance bridging said contacts and adapted to carry the current when said contacts are open, a signal lamp and the clutch-op55 erating coil being included in said circuit, said signal lamp being adapted to glow when the said contacts are in engagement. and to remain dark when the said contacts are open, and means in proximity to said said circuit, substantially as described.
4. In apparatus of the character described, a transmitter mounted upon a suitable standard, a signal lamp carried by the cally actuated phonograph connected with said transmitter, and means to supply current to cause the said signal lamp to glow when the said phonograph is in operative 50 position, substantially as described.

5 . In apparatus of the character described. a transmitter, an electrically operated phonograph connected therewith, including a phonograph cylinder support
the rotation of the former, a hollow standard for supporting said transmitter, and a switch contained in said hollow standard having a portion extending outwardly therethrough, and adapted to be closed by pressure upon said outwardly extending portion to supply current to said clutch operating coil, substantially as described.
6. In apparatus of the character described, an electrically operated phonograph. comprising a receiver, a stylus operated thereby to incise a wax cylinder, said receiver being pirotally supported and prorided with an arm having a hook at its free end, a rotatable screw-threaded shaft adapted to move the receiver longitudinally of the wax cylinder, a piroted arm having a threaded end for engagement with said screw-threaded shaft. and a latch connected with said arm and adapted for engagement with said hooked end to move the threaded arm out of engagement with the screw-threaded shaft and to hold the said stylus out of engagement with the said cylinder, substantially as described.
T. In apparatus of the character de- 85 scribed, a transmitter, a phonograph arranged at a distance from said transmitter and comprising a receiver adapted to actuate a stylus, a circuit betreen said transmitter and receiver comprising a suitable source of current. a clutch for stopping said phonograph when said receiver has moved a certain distance, an electro-magnet adapted when energized to hold said clutch in a position to cause the phonograph to operate, a circuit including said source of current connected to said electro-magnet. means for closing said circuits, an electric light arranged near said transmitter and in series with the circuit connected to said electromagnet. a second light of greater resistance than said first named light connected in series with the last named circuit and near said receiver, normally closed contacts connected to said last named circuit in such a 105 manner as to short circuit said second light. and means actuated by said receiver to open said contacts whereby the circuit is completed through said second light.

In testimony whereof I affix my signature 110 in presence of two witnesses.

## JOHN NOLL.

Witnesses:
Marie Reiml, Eugene Delatar.
$993.793$
J. A. RABBITT.
talking maciine.

## APPLICATION FILED FEB. 8, 1910.

993,793.
Patented May 30, 1911.


# UNITED STATES PATENT OFFICE. 

JAMES ALOYSIUS RABBITT, OF YOKOHANIA, JAPAN.
TALKING-MACHINE.
993,\%93.
Specification of Letters Patent. Patented May 30, 1911. Application filed February 8, 1910. Serial No. 542,711.

To all whom it may concern:
Be it known that I, James A. Rabbitt, a citizen of the United States, residing at Yokohama, in the Empire of Japan, have 5 invented certain new and useful Improvements in Talking-Machines, of which the following is a specification.

This invention relates to talking machines and has reference more particularly to the
10 construction of the sound-conveying and -amplifying devices for such machines.

The invention is directed to the provision of a talking machine of an improved construction, whereby a more compact struc-
15 ture and one which is of attractive appearance is provided, and such that an increased volume and a sweeter tone of the reproduced sounds are secured.

In accordance with the invention, the re20 produced sounds are carried from the sound-box through a passageway which passes through the box or casing employed as a support and an inclosure for the motor; within the casing the sound-conveying 25 passageway is divided into two diverging parts which pass one on cither side of the motor, thus forming a double resonance chanber. Each of these parts is of progressively increasing cross-sectional area, so
30 that the sounds are amplified while passing therethrongl. In this way a tapering sound-conveyer is provided which is of sufficient size to effect a substantial amplification of the sound, the employment of at
35 bulky tapering horn extending above the machine is avoided, and ample space for the motor is provided withont undue enlargement of the casing of the machine.

The invention further involves the pro-
40 vision of certain resonance devices in the somd-conveying passage which serve to angment the volmae of the reproduced somids and sweeten the tone, so that a more faithful reproduction of the recorded somuds is 45 obtained.

In the prefered embodiment of the invention, a support is employed moumted in the sombleonveying passage und carrying resohators which may be in the form of thin 50 leaves, cither motallic; or nom-metallic, increasing in width toward the end of the passage; the ends of these leaves or resomutors are free of the walls of the passage and
they vibrate in harmony with the sound waves thereby amplifying and improving 55 the tone of the reproduced sounds.

I have illustrated the preferred embodiment of my invention in the accompanying drawings, in which-

Figure 1 is an elevation of a talking-ma- 60 chine, broken away and sectioned in part. Fig. 2 is a top view of the machine, Figs. 3 and 4 are detail viervs in section on lines $3-3$ and $4-4$ of Fig. 2, respectively, and Fig. 5 is a detail view of the mounting for 65 the tone-arm.

Referring to these drawings, 1 indicates the casing of the machine, this being of the usual boxlike form. Within the casing is the motor, indicated at 2, this being arranged in the usual or any suitable mamer to drive a vertical shaft extending through the top of the casing and carrying a turntable 3 adapted to support a sound-record of disk form. The sound-box 4 is momited upon the free end of the tone-arm 5 with its stylus 6 adapted to track in the groove of the record on the turntable 3. The tone-arm 5 is momed for both horizontal and vertical movement upon a tubular member $\uparrow$ secured to and extending within the casing of the machine. The means for supporting the tome-arm thas is shown in detail in Fig. 5. The end of the tone-arm is pivotally connected by horizontally disposed pirot-pins 8 to a ring 9 which is adapted to move circmaferentially between the (op of the member 7 and a collar 10 threaded thereon.

Within the casing 1 of the machine the member 7 is enlarged and is divideal to ? form two passageways as shown al 11, one at sulstantially a right angle to the other and both extending from the top to the bottom of the easing. Each of these (wo passageways of the member $t$ is extembed to the side of the mathine opposite it by walls: $19,13,14 \mathrm{mal} 1.5$ : 1 rimged vertically the tween the (op) and hottom of the casing 1. so that two passageways for the somme waves mo provided from the menber 7 through the casing to the diatam sithes of the litter. 'The watls 12 and 1.5 mien suld stmotially parallel to two meljacent sides of the (:asing or thome sides of tha (:asing may be mitized to form tha walls of tas the somind passigeres and the walls $1: 3$ and 14

diverge from the walls 12 and 15 , respectively, so that the two sound passageways increase constantly in cross-sectional area to the ends thereof. Between the walls 13 and

## 5

 thas be seen that a double tapering soundconveying passage of substantial length is provided so that the reproduced sounds will be considerably amplified, that this sound- ably by having slots cut therein through which the resonators extend. The ends of the resonators extend in proximity to the walls of the passages but do not touch, as25 shown in Fig. 4, and the resonators are increased in width as the width of the passages increases. The resonators are preferably arranged as shown in Fig. 3, from which it will be seen that in each passage
30 there are a number of sets of the resonators, those of each set being arranged one above another and slightly curved in the direction of the length of the passage, the curvature of each set being opposite to that of the ad-

When the reproduced sounds pass through the sound-conveyer, they cause the free ends of the resonators 17 to vibrate in harmony with them and in practice $I$ have found that
40 this affects both the volume and the quality of the reproduced sounds by increasing the vohme and sweetening and clarifying the tone.

Having now described my invention, what
45 I claim as new therein and desire to secure by Letters Patent is as follows:-

1. A talking-machine comprising a rectangular casing, a motor therein, a turntable above the top of the casing driven by
50 the motor, a tone-arm pivotally mounted at one corner of the top of the casing, a soundbox carried by the tone-arm and adapted to coact with a record on the turntable, and a sound-conveyer leading from said tone-arm
55 within the casing, said conveyer being divided within the casing to form two branches extending along the sides of the casing adjacent to the corner where the tonearm is monted and having their exits at the
60 sides opposite, substantially as set forth.
2. A talking-machine comprising a motor, a turntable driven thereby, a sound-box adapted to coact with a record on said turntable, a sound-conveyer to which the sound-
box is connected, and a plurality of resonators supported intermediate their ends within the sound-conveyer and having their ends disconnected from the sound-conveyer so as to be free to vibrate in harmony with the sound-waves, substantially as set forth.
3. A talking-machine comprising a motor, a turntable driven thereby, a sound-box adapted to coact with a record on said turntable, a sound-conveyer to which the soundbox is comnected, and a plurality of thin resonators mounted within the sound-conveyer, curved in the direction of the length of the sound conveyer and having their ends free to vibrate in harmony with the soundwaves, substantially as set forth.
4. $\Lambda$ talking-machine comprising a motor, a turntable driven thereby, a sound-box adapted to coact with a record on said turntable, a tapering sound-conveyer to which the sound-box is connected, and a plurality of resonators mounted within the sound-conveyer increasing in width toward the large end of the conveyer and having their ends free to vibrate in harmony with the soundwa ves, substantially as set forth.

5 . $\Lambda$ talking-machine comprising a motor, a turntable driven thereby, a sound-box adapted to coact with a record on said turntable, a sound-conveyer to which the soundbox is connected, and a plurality of sets of resonators mounted within the sound-conveyer and having their ends free to vibrate in harmony with the sound-waves, adjacent sets of said resonators being oppositely curved in the direction of the length of the 100 conveyer, substantially as set forth.
6. A talking-machine comprising a motor, a turntable driven thereby, a sound-box adapted to coact with a record on said turntable, a tapering sound-conveyer to which the sound-box is connected, and a plurality of sets of resonators mounted within the sound-conveyer, having their ends free to vibrate in harinony with the sound-waves and increasing in width toward the end of the conveyer, adjacent sets of said resonators being oppositely curved in the direction of the length of the conveyer, substantially as set forth.
7. A talking-nachine comprising a motor, a turntable driven thereby, a sound-box adapted to coact with a record on said turntable, a sound-conveyer to which the sound box is connected, a support within the soundconveyer, and a phurality of thin resonators extending through openings in said support across the sound conveyer and having both ends thereof free to vibrate in harmony with the sound-waves, sulstantially as set forth.
8. A talking-machine comprising a motor, a turn-table driven thereby, a sound-box adapted to coact with a record on said turntable, a tapering sound-conveyer to which

the sound-box is connected, a support within the sound-conveyer, and a plurality of sets of thin resonators extending through openings in said support, having both their
5 ends free to vibrate in harmony with the sound-waves and increasing in size toward the end of the sound-conveyer, adjacent sets of said resonators being oppositely curved
in the direction of the length of the conveyer, substantially as set forth.

This specification signed and witnessed this 22nd day of December, 1909.

JAMES ALOYSIUS RABBITT.
Witnesses:
J. K. Caldwell,

Genji Kuribara.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
S. T. E. \& J. E. WHITE.

PHONOGRAPH.
993,931.
Patented May 30, 1911.

S. T. E. \& J. E. WHITE.

PHONOGRAPH.
APPLIOATION FILED OOT. 14, 1910.
993,931.

Patented May 30, 1911.
2 SHEETS-SHEET 2.


# UNITED STATES PATENT OFFICE. 

SEPTIMUS T. E. WHITE, OF OKLAHOMA, OKLAHOMA, AND JOHN E. WHITE, OF NEW YORK, N. Y.

PHONOGRAPH.
$\mathbf{9 9 3}, 931$.
Specification of Letters Patent. Patented May 30, 1911. Application filed October 14, 1910. Serial No. 587,019.

## To all whom it may concern:

Be it known that we, Septrind T. E. Wirte, a citizen of the United States, and a resident of Oklahoma city, in the county 5 of Oklahoma and State of Oklahoma, and John E. White, a citizen of the United States, and a resident of the city of New York, borough of the Bronx, in the county and State of Nerv York, have invented a
10 new and Improved Phonograph, of which the following is a full, clear, and exact description.

This invention relates to an improvement in phonographs, whereby the effect of the
15 vibrations imparted to the stylus by the disk or cylinder or any other type of recording tablet is modificd by a plurality of diaphragms, thereby increasing the distinctness and volume of the sound.

An object of this invention is to provide an attachment for a phonograph in which a plurality of diaphragms are connecter to a single stylus, whereby the effect of the movement of the stylns is amplified, with means for rarying the number of diaphragms which will be operative at any time.

A further object of this invention is to provide an attachment for a phonograph which includes a plurality of someding diat-
30 phragms or somnding boxes, connected cither in series or multiple, with a primary sonnding box or diaphragm.
These and further objects, fogether with the construction and combination of parts, will be more fully described hereina fler and particularly set forth in the clams.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of ref-
40 erence indicate corresponding parts in all the views, and in which-

Figure 1 is a porspective view showing one form of our device. in which the somiting boxes are comeneted in series; Fig. a :
45 a fragenentary vertical section of the forme shown in Fig. 1; Fig. 3 is an culargend detail farmentary view of the frame with one af the rings memoved to show the underlyiner structure: Fig. 4 is a horizontal section on
50 the line 1 of rig. 2; Fig. to is a persperetive detail view of one of the adjusting rings. rige. of is a detmil perspertion view of the lock for secmering the cuds of one of the udjusting rings together; Fig. 7 is mn
enlarged view of one of the connections be-
trreen a pair of juxtaposed diaphragins or sounding boxes; Fig. 8 is a fragmentary plan view of another form of our invention, in which the auxiliary sounding boxes are shown connected in multiple with the pri- 60 mary sounding box; and Fig. 9 is a fragmentary view in clevation, partly in section, of the form shown in Fig. 8.
Referring more particularly to the separate parts of the device, 1 indicates the main 65 or primary sounding box, which is provided in cither form of our invention. The sounding box is provided with a diaphragm 2 of any suitable structure, which is adapted to simnlate the vibrations of a style 3 by being operatively connected thereto by means of a connecting member, such as a wire 4 , and a style holder 5 . The style may be held in engagement with a record tablet, such as : cylinder or disk, in any suitable manner, as75 by means of a pivoted weighted lever ( $;$, which is commonly found in several makes of phonographs now on the market. As far as we are aware, the motion of the style has $11 p$ to this time been transmitted to but a so single sounding box and the diaphragm thereof. In our invention, we connect a plurality of other auxiliary somding boxes 7, 8, 9 and 10 to the primary somding box 1. in such a manner that the diaphagm ?85 thereof will operate the diaphragm of the anxiliary somnding boxes so as to calme them to vibrate and this: :mplify and intensify the some of the original somding box. Theee someding boxes may be comaned- 90 ed in series, as illustrated in Figs. 1 to 4. or in multiple, as illustrated in Figes $S$ and 9. The advantage of the multiple system over the series system is that if a single intermediate somiding bor, or the comere tions thereot. shonld berome out of order. it would mot disturl the action of the othere sominding buxes. On matel of the diraphatams. Hare ure provided luge 11, which extend from oppresite sides of the dia- 100 phagms. and having opromes therein. throngh which are inserted the emmeding wires from the style 3 to the first diaphragm. and from the preoceling diaphrarns to the sumeereding diaphongms. As will be seen by 105 refermere to rig. II. the combertions nit shown in the form of wites $12,1: 3$ and 11. having interlocking lomps formod in thoir
ends, so as to permit a relative morement of the wires, to bring the succeeding diaphragm or diaphragms into operative connection with the preceding diaphragm or 5 diaphragms. In the case of the last few of the sounding boxes, for instance 9 and 10 , these connections are provided with springs 15 , which permit a slight relative adjustment of the sounding boxes after they have This prevents the breakage of the connections in case some of the preceding connections are adjusted after the succeeding connections have been tightened up.
For the purpose of supporting the various sounding boxes in spaced relation, there is provided a frame 16 , which may be of any suitable structure, and is provided with lugs 17 engaging the opposite sides of adjusting
20 rings 18. There are preferably three of these lugs to each side of each ring, so as to form a tri-point support determining a plane. These rings are provided with cam or screw slots 19 , in which extend projec-
25 tions 20 on the sounding boxes 7 to 10 , in the form shown in Figs. 1 to 7 . The rings 18 may be of any suitable structure, but a preferred form is illustrated in Figs. 5 and 6, which is shomn as consisting of a band har-
30 ing the ends turned orer, as at 21 , to form locking joints with a clip 22, which is adapted to be inserted orer the edges of the band and engage the turned-orer ends 21 , so as to secure the ends of the band together. The lar flange 23 , which permits it to be readily grasped and manipulated. The projections 20 on the sounding boxes pass through rertical slots 24 in the casing or frame 16, there-
40 by preventing the sounding boxes from becoming out of register with each other when manipulated relative to each other, and to the frame 16 . It will thus be seen that by rotating the adjusting rings 18 , each soundthe precelin oper bin the preceding sounding box by tightening the connection between them, so that the vibrations of the preceding diaphragm will be transmitted to the succeeding diaphragm.
50 In case all of the connections are tight, every diaphragm will ribrate when the style 3 vibrates. The sounding boxes may be connected in series by suitable outlet conduits 25 , to a common horn 26, as illustrated in
Fig. 1, or they may be connected to separate and distinct horns 27, as illustrated in the form shown in Figs. 8 and 9. By reason of the construction of the form shown in Figs. 1 to 7 , the wire connections must pass
60 through openings 28 in the outlet conduits 25. These openings are closed as much as possible by means of flexible corerings 29, which may be of any suitable material, such as adhesive tape, rubber or the like, so as to
shown in Figs. 8 and 9, the vibrations of the main or primary sounding box 1 are transmitted from this diaphragm to the diaphragms of the auxiliary sounding boxes grouped around it, by means of individual
transmitting connections. These connections may be of any suitable form, and are shown as comprising levers 30 pivoted intermediate their ends and connected by flexible wires 31 and 32 , respectively, to the diaphragms of the main and the auxiliary sounding boxes. In order that any one or all of these auxiliary sounding boxes may be thrown into or out of operative connection with the main sounding box, the pirotal supports for the levers 30 are shown adjustable, and in this case, are illustrated as being formed of rods 33 , adjustably connected by scremthreaded connection with a frame 34 in the form of an annular ring. In this latter form, the main sounding box may or may not be provided with an outlet conduit 35 , which may be connected in series, with the other conduits, to a common horn, or to a separate individual horn.
The operation of the device will be readily understood when taken in connection with the above description. In either form, the machine is so located on the frame of the phonograph that the style 3 will engage the cylinder, disk, or other form of record tablet, and thus produce either a record on the record tablet or reproduce a song, speech, or other collection of sounds by vibrations of the diaphragm of the primary or main sounding box 1. In the form shown in Figs. 1 to 8 , any number of the successive sounding boxes may be operatirely connected successively to the main sounding box 1 so as to lave their diaphragms ribrated simultaneously with the vibrations of the main diaphragm. A simple turn of any one of the rings 18 disconnects or connects the succeeding sounding box or boxes with the preceding sounding box or boxes. If any one of the preceding boxes are disconnected, those following will naturally also be operatively disconnected from the style 3. In the form shown in Figs. 8 and 9, where the sounding boxes are shown arranged in multiple, any or all of the auxiliary sounding boxes can be operatively connected to the main sounding box by simply adjusting their pivoted screws 33 . It will thus be seen that the ribrations produced in the main sounding box can be modified and intensified by adding to the effect of the main sounding box the effect of one or more auxiliary sounding boxes.

While we have shown two embodiments of our invention, we do not wish to be limited to the specific details thereof, but desire to be protected in various changes, modifications and alterations which may come within the scope of the appended claims.

Having thus described our invention, we
claim as new and desire to secure by Letters Patent:-

1. The combination with a main sounding box, of means adapted to engage a
5 record tablet to transmit sound impulses between said record tablet and said main sounding box, one or more auxiliary sounding boxes adapted to have the vibrations of the one imparted to the other, con-
10 nections between said main sounding box and said auxiliary sounding boxes for transmitting the vibrations of the one to the other, and means for throwing said connections into and out of active relation with
15 said sounding boxes.
2. A phonograph attachment, comprising a plurality of sounding boxes operatively connected to a single style, the latter being adapted to transmit sound vibrations be-
20 tween said sounding boxes and a tablet, and means for operatively disconnecting one or more of said sounding boxes from said style.
3. A phonograph attachment, comprising

25 a plurality of sounding boxes, connections between the diaphragms of said sounding boxes adapted to transmit the vibrations of one to the others, and means for controlling the connections between said diaphragms.
4. A phonograph attachment, comprising a single style, a plurality of sounding boxes operatively connected to said style, said style being adapted to transmit sound vibrations between a record tablet and said
35 sounding boxes, and means for selectively disconnecting any number of said sounding boxes from said style.

5 . The combination with a style of a plurality of sounding boxes arranged in series,
40 means for connecting each sounding box with the next adjoining sounding box, so that the vibrations of the one will be transmitted to the other, and individnal means for varying the connection between satid
45 sounding boxes.
6. The combination with a style, of a series of sounding boxes, one of said sommding boxes being diredly connected to said style, loose commedions between said somel-
50 ing boxes, and moans for tieghtening said loose conmections, wherehy said somnding boxes may be operativoly eomered tomethere so that the vibrations of one will be transmitted to the others.
7. 'The combination witl a style, of' is series of somnding boxes, one of said sommding boxes being diredly conneeted to said
style, loose connections between said sounding boxes, and means for tightening said loose connections, whereby said sounding boxes may be operatively connected together. so that the vibrations of one will be transmitted to the others, some of said connections having a spring located therein.
8. The combination with a style, of a 65 sounding box having a diaphragm operatively connected to said style, a plurality of sounding boxes having their diaphragms loosely connected in series with said firstmentioned diaphragm, and individual means for varying the tension on the connection between said diaphragms, whereby one or more of said second-mentioned diaphragms can be operatively connected to said first-mentioned diaphragm for the 75 purpose of reproducing the vibrations of said style.
9. The combination with a casing, of a series of sounding boxes arranged in spaced relation in said casing, rings rotatably so mounted on said casing and having cam slots therein, lugs on said sounding boxes engaging said cam slots, whereby the rotation of said rings will vary the relative position of said sounding boxes, and means for operatively connecting said sounding boxes together, so that the vibrations of the one may be transmitted to one or more of the others.
10. The combination with a casing, of a 90 series of sounding boxes arranged in spaced relation in said casing, rings rotatably mounted on said casing and having cam slots therein, lugs on said sounding boxes engaging said cam slots, whereby the rot:tion of said rings will vary the relative position of said sounding boxes, and loose connections between said sounding boxes, which may be tightened by the manipulation of said rimgs to operatively comeed said sounding boxes logether, so that the vibrations of one will be transmitted to the othiers.

Th testimony whereof we have signed our names to this specification in the presereer 105 of two snbseribing witnesses.

> SEPTIMUS I' \&. WIITE.
> JOHN E. WIITH.

Witnesses for Septimus ' I '. W: White:
A. I. Welsit,
J. M. Owen.

Witnesces for Johon lis. Whito:
Honisto Whimeno,
Phmar I). Romataus.

Copies of this patent may be obtained for five oents cach, by nddressing the "Commissioner of yntents. Washington, D. C."
R. L. GIBSON.

SOOND BEPRODOOING MACHINE.
APPLIOATION FILED DEO. 22, 1900.

993,980.

Patented May 30, 1911.
2 SHEETS-SHEET 1.

R. L. GIBSON.

SOOND REPRODOCING MACHINE.
APPLICATION FILED DEO. 22, 1906.
993,980.
Patented May 30, 1911.
2 SHEETS-SHEET 2.


FIG. 2


FIG. 5
Tobern \&. Sibsone


# UNITED STATES PATENT OFFICE. 

## ROBERT L. GIBSON, OF PHILADELPHIA, PENNSYLVANIA.

SOUND-REPRODUCING MACHINE.
993,980.
Specification of Letters Patent. Patented May 30, 1911. Application filed December 22, 1906. Serial No. 349,018.

## To all whom it may concern:

Be it known that I, Robert L. Gibson; of the city and county of Philadelphia, State of Penusylvania, have invented an Improve-
5 ment in Sound-Reproducing Machines, of which the following is a specification.
My invention has reference to sound reproducing machines and consists of certain improvements which are fully set forth in
10 the following specification and shown in the accompanying drawings which form a part thereof:
The object of my invention is to provide a construction of machine which is adapted to
15 employ a record tablet in disk form and which, in the operation of the record groove upon the stylns, will canse said record groove to travel in contact with said stylus at a uniform speed throughout the entire
20 length of the groove.
My object is also to provide a construction of machine in which the sound box shall remain normally stationary while the record tablet is caused to travel under it to
25 bring the different portions of the record groove in succession into operative position with respect to the stylus.

My invention consists of means for roiating a record table and simultaneonsly
30 therewith shifting the axis of rotation relatively to a stylus of a somnd box whereby successive portions of the record groove are bronght into operative position with the stylus and whereby the sound box may be rela-
25 tively stationary with respect to the record fablet.

My invention also consists of the combination of a rotating support for a record tablet combined with a somad box and sty-
40 hus, and menns for rotating the support of the record tablet with a gradually varying speed whereby the speed of travel of the record groove is substantially coustaut.

My invention also comprehends other fea-
45 tures of construction in a somed reproducing marchine, which, together with the featmes above specified, will be better moderstood by reference of the drawings, in which:
ligume 1 is a side clevation of $a$ somal
50 reprodncing machine with n portion broken away to show the interion and mborlying my imporements in its constration: Fi, 2 is a plan view of the same: lifor. 3 is an cud view throngh a portion of the aranine
driving mechanism for the record tablet support; and Fig. 5 is a sectional riew of the detail for comnecting and disconnecting the record tablet support with the trans- 60 mitting gearing.

A is the case of the machine.
$B$ is the power motor of the usual spring type.

C is the turn-table upon which the record 65 tablet disk D is supported.

E is the bridging bracket carried upon the upper part of the case and having a horizontal tubular extension $\mathrm{E}^{\prime}$.

F is the sound box having its stylus $\mathrm{F}^{\prime} 70$ resting in contact with the record tablet $D$, and G is the horn or amplifier carried upon a vertical tubular aperture of the bracket E.
The character of the record tablet adapted for use in connection with my improved machine is of a construction in whicl the record groove is so formed in different parts of the spiral that the speed of travel of the disk must be varied approximately in a contimuons manner while the stylus travels from one end of the spiral groore to the other so that the surface speed of the groove under the stylus is substantially constant.

The turn table or support C is pivoted upon a pin $i$ extending upwardly from a 85 sliding carriage I which is guided horizoutally upon the gnide rods $\Pi$ II. A rotating feed serew $J$ is arranged between the parallel grides HI II and is driven hy the spring motor B through gearing, to be later 90 described.
$J^{2}$ is a lever which is pivoted at $j$ to the carrigge 1 and has its immer che hinged to a half nut J' which engages the threads of the serew J when forced down mpon it imder the action of the spring $k$ oprating upors the lever J: By depreseing the fres end of the lever Jo the mat ! may be mixal from the serew and, when in this position. the torn-table (and its carrage l may be 100 shifted freely mpon the ernides II. 'This ac tion is facilitatem ly mising fle tom taldo © from ofl' the driving wheel 1 by the rain ing of the pins which is earried by dow frame 1 and is aded upom ly the imere cond 105
 dows mot tomeh the pian su that the and pind dex mot inter fere with the free retation of the farn fuble. 'The turn-tuhte is smmeth \#1pmits mader side and momally yove upon 110 Hhe rotating driving whed S. this wherl ber tiger driven lye the spring motor in any ant
able manner. In the particular illustration shown, the wheel $L$ is secured upon a sleeve $L^{\prime}$ journaled upon an extension K of the screw shaft $J$ and is rotated by means of ${ }^{\text {gears M M }} \mathrm{B}^{\prime}$ connecting with the spring motor B . The screw shaft $J$ is provided at its rear end with a spur gear $\mathrm{K}^{\prime}$ which meshes with a pinion $K^{2}$ on the shaft N and by means of
10 which gears the feed screw shaft J is rotated with a much slower speed than the sleeve $L^{\prime}$ and its driving wheel L. Any other suitable construction of gearing or manner of driving the parts $J$ and L may be
15 employed, as will occur to anyone skilled in the art, the mechanism here shown being merely an example of devices which may be suitably employed. The driving wheel L , may be provided on its periphery with rub-
20 ber, as at $l$, if so desired.
The sound box F may be of any suitable construction and may have an adjustable rotation on a horizontal axis in the end of the tubular arm $\mathrm{E}^{\prime}$ so as to be able to turn
he stylus up or down with respect to the record tablet, to permit the changing of the record tablets and also to bring the stylus into normal adjustment. A spring $f$ may be employed for holding the stylus point in 0 contact with the record tablet or elevated from the same according as to the adjustment of the sound box whether for playing or when changing the record tablets.

The operation of my improved machine 35 will now be understood: The machine being in the position shown in Fig. 1, and having just completed the reproducing of sound from a record tablet, the stylus of the sound box is turned upward by rotating the sound new record tablet is placed in position. The motor is then put into operation. The sound box is then rotated into position to bring the stylus into contact with the record tation of the feed screw $J$ and the driving wheel $L$, the turn-table is rotated and at the same time its axis of rotation $i$ is shifted longitudinally with respect to the somnd box
50 and stylus so that the surface speed of travel of the record groove under the stylus remains substantially constant. This continues until the record tablet has been, together with the turn-table, shifted to bring and which has completed the reproduction of the sound from the record groove of that particular tablet. The lever $\mathrm{J}^{2}$ is then depressed and the carriage I and turn table pulled again to position shown in Fig. 1 and a new record disk tablet substituted for that from which sound was before reproduced.

The result of reproducing sound from a record tablet in the manner herein referred to, namely one in which the record groove is
so formed and the machine so operated that uniform or constant speed of travel of the record groove under the stylus is insured, results in a more perfect articulation or production of sound than where the surface
 speed of travel of the record groove is constantly varying as in the case of the gramophone instruments as they are commercially constructed and operated. It will be seen, however, that an ordinary gramophone 75 record tablet would not be suitable for use in a machine of the character herein described because the speed of travel of the turn-table carrying the record disk is constantly changing and hence would cause the gramophone record to travel at a rate of speed which would be inconsistent with that employed when producing the master record from which it was made; and consequently, the record tablets for my improved machine must be specially made and adapted for a machine of this character only.

While the construction shown is excellently adapted for the purposes of my invention, I do not confine myself to the details, as these may be considerably raried without departing from the principles of my invention.
Haring now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a machine for reproducing sound, the combination of a rotating turn-table for the sound record tablet, a sliding frame in which the turn-table is journaled on a vertical axis and by which it may be shifted, mechanical feeding derices for feeding the sliding frame uniformly, power mechanism for directly rotating the turn-table independently of the feeding derices, means attached to the sliding frame for simultaneously disconnecting the turn-table from the feeding derices and from the porrer mechanism which rotates it and provided with an extension forming a handle by which the frame may be moved when freed from the feeding mechanism, a sound box, and a fixed support abore the turn-table in which the sound box is journaled.
2. In a machine for reproducing sound, the combination of a rotating turn-table for the sound record tablet, a sliding frame in which the turn-table is journaled and by which its axis may be shifted. mechanical feeding devices for feeding the sliding frame uniformly, means extending beyond the turn-table for mechanically connecting the sliding frame with the feeding derices or disconnecting it therewith and directly moring the sliding frame independently of the feeding devices, a fixed frame arranged abore the turn-table, and a sound box having a tubular part journaled in the fixed frame on an axis parallel to the turn-table but to one side of the plane of trarel of the axis of
the turn-table and having the stylus point arranged to make contact with the record tablet upon the turn-table approximately in the rertical plane of the travel of the axis of 5 the turn-table.
3. In a machine for reproducing sound, the combination of a turn-table for the record tablet, a sliding frame upon which the turn-table is journaled, a stationary 10 bracket extending over the sliding frame and turn-table and provided with a tubular passage above the turn-table terminating at one end in an upright opening and at the other end in a horizontal opening, a sound 15 box rotatably journaled in the horizontal opening of the bracket and with its diaphragm at right angles to the line of travel of the turn-table and sliding frame, and an amplifying horn supported from the vertical 20 opening of the bracket.
4. In a machine for reproducing sound, the combination of a turn-table for the record tablet, a sliding frame upon which the turn-table is journaled, a stationary bracket
25 extending over the sliding frame and turntable and provided with a tubular passage terminating at one end in an upright opening and at the other end in a horizontal opening laterally disposed to a vertical plane 30 through the central line of travel of the turn-table, a sound box journaled in the horizontal opening of the bracket and with its diaphragm at right angles to the line of travel of the axis of the turn-table and slid-
35 ing frame, means for holding the sound box in an adjusted position with the stylus point in operative connection with the record on the turn-table and also out of such position when desired, and an amplifying horn sup-
40 ported from the vertical opening of the bracket.
5. In a machine for reproducing somed, the combination of a turn-table for the record tablet, a relatively stationary sound box and
45 stylns, feeding means independent of the tim-table and its rotating means for slowly moving the axis of the turn-table toward the sonnd box, means for rotating the turn-table withaspeed which gradually mereases where-
50 hy the surface speed of travel of the record groove of the tablet moder the stylus will he substantially constant, and means for conmeting on disemmecting the furn-table with the means for rotating it and withont re-
f. In a machine for reprodncing sombd, the combination of a turn-table for the reecord tabled, a relatively stationary somm box and styhus, means indepemdent of the then lable and its rotating memns for showe mow somud box, means for mating the tum-able withasperd which grmatally meremes wherehy the surface spered of thatel of the record groove of the athel muder the stythes will he.
substantially constant, and means for connecting or disconnecting the turn-table with the means for moving the axis of the turntable toward the sound box.
6. In a machine for reproducing sound, 70 the combination of a turn-table for the record tablet, a relatively stationary sound box and stylus, means independent of the turntable and its rotating means for slowly feeding the axis of the turn-table toward the sound box, means for rotating the turn-table with a speed which gradually varies whereby the surface speed of trarel of the record groove of the tablet under the stylus will be substantially constant, and means for simultaneously arresting the rotation of the turntable and for disconnecting it from the feeding means and adjusting it relatively to the sound box.
7. In a machine for reproducing sound, the combination of a fixed frame having a tubular part provided with vertical and horizontal openings, a horn extending from the vertical opening of the tubular part, a turn-table arranged below the tubular part, means for rotating the turn-table and feeding it relatively to the tubular part, and a sound box loosely held so as to be rotatably supported by the horizontal opening of the tubular part on an axis parallel to the turntable and said sound box having a stylus adapted for contact with a record tablet on the turn-table.
8. In a machine for reproducing sound, the combination of a frame having a tubnlar part provided with vertical and horizontal openings, a horn extending from the vertical opening of the tubular part, a turntable arranged below the tubular part, means for rotating the turn-table and feeding it relatively to and from the thbular part, a sound box loosely held so as to be rotatably supported by the horizontal opening of the cubatar part on an axis parallel to tho turntable and at right angles to tho diaphragm and having a stylus adapted for yichling contact with a record tablet on the tamtable, and hand operated devices extending beyond the turn-table for arresting the rotation of the turn-table and shifting it redatively to the sombl hox.
9. In a machine for reprodmeing somed, the combination of a frmme having a tuhntar part provided with rertioal and homizontal openings, a hom extonding from the wertical opening of the tubular part, a dime Cable mranged below the fulnhar part, means: for rotating the tmotahle and feeding it
 towesty lied so as to be rotatahly sinperted ly the horizontal opening of the fombar part on an axis paralled for the tarn table and at right angles to the diaphragmen having a stytus ndapted for vichting confact with a recod tablet on the tumt tuble90
hand operated devices extending beyond the turn-table for arresting the rotation of the turn-table and shifting it relatively to the sound box, and a spring device for holding the stylus of the sound box down to the record tablet on the turn-table or in an elevated position as desired.
10. In a machine for reproducing sound, the combination of a bracket having a tubular part directly over the turn-table formed with vertical and horizontal openings, a horn carried by the bracket and in connection with the vertical opening, a sound box carried by the bracket and connected with the horizontal opening thereof, a rotating turntable for the record tablet arranged below the tubular part of the bracket, and means for feeding the turn-table transversely to the sound box.
11. In a machine for reproducing sound,
the combination of a bracket having a tubular part directly over the turn-table formed with rertical and horizontal openings, a horn carried by the bracket and in connection with the vertical opening, a sound box carried by the bracket and connected with the horizontal opening thereof, a rotating turntable for the record tablet arranged below the tubular part of the bracket, means for feeding the turn-table transversely to the sound box and uniformly toward the bracket and sound box, and hand device for moving the turn-table away from the said bracket and sound box.

In testimony of which invention, I here- 35 unto set my hand.

ROBERT L. GIBSON.
Witnesses:
R. M. Hunter,
R. M. Kelly.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
195.247

SOUND RECORDING AND REPRODUCING MACHINE.
995,347 .
Patented June 13, 1911.

D. H. HAYW00D.

SOUND RECORDING AND REPRODUCING MACHINE.
995,347 .


## D. H. HAYWOOD.

SOUND RECORDING AND REPRODUCING MACHINE.
applioation filed deo. 24, 1909.
Patented June 13, 1911.

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4 \text { SHEETS-SHEET } 3 .
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D. H. HAYWOOD.

SOOND RECORDING AND REPRODOCING MACHINE.
995,347.
APPLIOATION FILED DEO. 24, 1909.
Patented June 13, 1911.
4 SHEETS-SHEET 4.


# UNITED STATES PATENT OFFICE. 

DANIEL HOWARD HAYWOOD, OF NEW YORK, N. Y.<br>SOUND RECORDING AND REPRODUCING MACHINE.<br>Specification of Letters Patent. Patented June 13, 1911.<br>Application filed December 24, 1909. Serial No. 534,834.

995,34\%.

## To all whom it may concern:

Be it known that I, Daniel Howard Haywood, a citizen of the United States of America, and a resident of New York,
5 county and State of New York, have invented certain new and useful Improvements in Sound Recording and Reproducing Machines, of which the following is a specification, reference being had to the accom10 panying drawings, forming a part thereof.

In U. S. Letters Patent No. 948,137 which issued to me on the 1st day of February, 1910, a sound record is shown and claimed in which the sound groove, independent of
15 its sound producing undulations, advances irregularly throughout its length, and my present invention relates to a machine for producing such a record and for reproducing sound from a record of such char-
20 acter. Sound producing records are commonly made by simultancously rotating the record blank and producing a relative feeding movement between the record blank and a record stylus. In my present machine I
25 provide, in addition to these two movements, for a third movement, namely, a relative lateral movement between the rotating sound record and the stylus independent of the feeding movement above referred to. It is,
30 of conrse, apparent that in the broad aspect of my invention, the feeding may consist either of a lateral movement of the record blank while it is being simultaneously rotated, the stylus being meanwhile held sta-
35 tionary so fiar as such feeding movement is concerned, or a lateral movement of the stylus while the record is relatively stationary with respect to. such lateral movement. Similarly the independent lateral
40 movement may be given cither to the styhns or to the record and that regardless of to which of these elements the feeding movements are imparter.

For the purpore of the present specifica-
45 tion, I have deseribed and illnstrated a machine in which the feeding movements are imparted to the recond simmtameonsly with movements of rotation thereof, white I have providerl that the independent movements
50 for cemsing the irregulatity of the somber grove are imparted fo the sivhus, but it will be understond that the same is intended in no way as a limitation of my invention, but rather ins an illustrative of ime form of the
55 machine emborlying my invention. It will also be maderstood that white for clemmess
of description I will refer to the machine mainly as a machine for producing the sound records, the machine may be similarly used with a reproducing stylus for reproducing the sound as will be well understood by those skilled in this art.

In order that my invention may be fully understood, I will now proceed to describe an embodiment thereof, having reference to 65 the accompanying drawings illustrating the same, and will then point out the novel features in claims.

In the drawings: Figure 1 is a top view of a machine constructed in accordance with 70 my invention, certain portions thereof being broken away to show other parts beneath them. Fig. 2 is a view in partial transverse section and partial side elevation thercof.

Fig. 3 is a view in longitndinal section 75 through the record support and means for imparting rotational and feeding movements thereto. Fig. 4 is a detail transverse sectional view through one form of feed mit employed. Fig. 5 . is a detail transierse sec- 8 tional view showing a modified form of the mechanism for imparting the irregular movements to the stylus. Fig. 6 is a detail face view of a record which may be produced in the machine.

The machine comprises a drive shaft 10 momed in stitable bearings 11 upon the main frame 12 of the machine. the sald shaft being rotated by any snitable power clement (not shown) suitably connecter thereto as by means of a gear wheel 13. The said drive shaft is arranged in pplinerd comnection with the secondary shatt $1-1$, one portion of which is serew-threaded as: at 1.5 whereby the said shaft comstitutes a foed shaft in addition to a shaft for trammitting rotary motion. Rotary motion is tamsmitfed from the said shalt lye means of !initar gean whels 16 and 17 , hio former heingesemed fast to the shaft 1.1 mat the latter mommod lemioly upom an atml 18 which is
 riage is momed in wiss in floc hame plate $1: 2$ of the mathine and is arraned to shele lomgithdinally themen in a path parallal 105 with the axes of the shalts 10 and 11 .

Robalimely semmed with the miter gear when 18 is an mond amine sor Fom inspedtion of the drawings, it will matily ba matrotanel that menry moncments of the 110 shaft 10 nere imparten for the shaft 11 therethatigh, the miter irams 16 and 16 to tho
record carrier 20. The threaded portion 15 of the shaft 14 is arranged in engagement with a feed nut 21 whereby as the said shaft $1+$ is rotated in one direction, i.e. clockwise, 5 the said shaft will be gradually drawn to the left as riewed in Fig. 3, and as the carriage 19 is retained against relative longitudinal morement between the gear wheel 16 and a collar 43, the said carriage is thereby simi-
10 larly moved, and with it the record carrier 20. The screw-threaded portion 15 has the proper pitch to give the desired feed so that the record will be simultaneously rotated and fed laterally in the operation of the ma-
15 chine. The feed nut 21 is conveniently formed in two portions, 22-23 (see Fig. 4) which are carried by arms adapted to be thrown in opposite directions by a suitably operating member 24 , whereby the shaft may
20 be released at the end of a feeding operation to permit the carriage 19 to be quickly returned to its initial position in which it is shown in Fig. 3 of the drawings. The record carrier 20 forms a support for a
25 record blank 25 , and a stylus 26 carried by a sound box 27 which is in turn carried by a tone arm 28. is arranged for engagement with the said record. The tone arm 28 is arranged to swing horizontally about a ver-
30 tical axis so that it may have a lateral movement with respect to the record carrier. In the present instance, the said arm 28 is provided with a vertical shaft suitably mounted in a bearing 30 formed as a part of the frame vided for the purpose of reducing the friction between the supporting means and the said arm so that the said arm will turn freely and with a minimum of effort. At its
40 lower end the said shaft 29 is provided with an arm 32 by which it may be operated. The means here shown for operating the same comprises a cam 33 of the type commonly known as an eccentric, monnted upon thereby and an eccentric rod 35 connected with the said strap and having a ball and socket comnection 36 with the said arm. A rotational movement of the shaft 10 will duce an oscillating movement of the arm 32 through the eccentric mechanism just described, which oscillating movement will be imparted to the tone arm 28 , the same resulting in a lateral morement of reciprocation of the stylus 26 . with respect to the record carrier. As this movement is produced simultaneously with the rotation of the record carrier and simultaneously with the feeding morement thereof, and a com-
 plete rotation of the record carrier, it will follow that the stylus will be caused to describe a spiral mpon the record blank which is eccentric to the axis of rotation thereof,-
65 and the groore resulting therefrom will in
its general direction, adrance and recede transversely as the record is revolved.

Other forms of irregular groove may be produced by rarying the movements imparted to the tone arm, and in Fig. 5 I have shorrn a cam or eccentric 37 carried by a shaft 38 connected by gearing 39-40 with the shaft 10 , the gearing having such a ratio that the shaft 38 will revolve twice to one revolution of the slaft 10. Instead of producing a regular spiral which is eccentric to the center of rotation of the record carrier as in the form above described, such an arrangement will produce a form of groove which might be termed an "oblong spiral", this, of course, being for the reason that the stylus will have two reciprocating or oscillating movements for each revolution of the record carrier instead of one as in the first example shown. In Fig. 6, I have shown somewhat conventionally such a record. By using different forms or relationship of gearing, or cams or eccentrics of different character any desired form of groove may be produced as will be well understood. In case the record thus produced is to be employed later in a positive feed machine, it will be necessary that the record be placed in the same relation in the reproducing machine as it occupied in the record machine, and for this purpose, I may employ an eccentric projection 41 upon the record table for coengagement with a corresponding recess upon the under side of the record. On the contrary, if a record of this kind be used upon a "Berliner" type of machine in which no positive feed is employed, such a positioning element and recess will not be necessary for this purpose, though it may be employed if desired in the recording machine for the purpose of holding the record blank steady while the record is being produced.

What I claim is:

1. In a machine of the character described, the combination with two elements, one comprising a record support and the other a stylus carrier, of means for imparting relative rotational morements and relative lateral movements between the two said elements, and means for also imparting lateral movements of reciprocation to one of the said elements with respect to the other.
2. In a machine of the character described, the combination with two elements, one constituting a record support and the other a stylus carrier, of means for imparting feeding movements to one of the said elements with respect to the other, means for simultaneously rotating the said record support. and means for simultaneously imparting movements of reciprocation to one of the said elements in the direction of said feeding movements.
3. In a machine of the character described the combination with a record sup-
porting element, a stylus carrying element, and means for rotating the record carrying element, of means for imparting lateral feeding movements to one of the said ele-
5 ments with respect to the other and for simultaneously imparting lateral movements of reciprocation to the stylus carrier in the direction of the said feeding movements.
4. In a machine of the character de-

10 scribed, the combination with a record support, means for rotating the same, and means for simultaneously imparting lateral feeding movements thereto, of a stylus carrier, and means for imparting lateral move-
15 ments of reciprocation to the said stylus carrier.

5 . In a machine of the character described, the combination with a record supporting element, a stylus carrying element,
20 and means for rotating the record carrying element, of means for imparting lateral feeding movements to one of the said elements with respect to the other, and a cam for simultaneously imparting lateral move-
25 ments of reciprocation to the stylus carrier in the direction of the said feeding movements.
6. In a machine of the character described, the combination with two elements,
30 one constituting a record support and the other a stylus carrier, of means for rotating the record support, and means including a feed screw and a cam for simultaneonsly imparting lateral feeding movements to one of the said elements with respect to the other and movements of reciprocation to one of the said elements with respect to the other, in the direction of the said feeding movements.
407 . In a machine of the character described, the combination with a record support and a stylns carrier, of means for rotating the record support, and means for feeding the stylus across the face of a record
45 supported by the said record support, and for alternately advancing and receding it during its feeding movencut.
8. Th a machine of the chatacter described, the combination with a record car-
50 rier, means for rotating it, and means for simultaneonsly impanting lateral feeding movements thereto, of a tome amm pivoted about an axis at right angles to the face of the record carrier, a sombl box carried thepe-
55 by, and means for oscillating the tone arm ahout its pivotal suppot during the feeding movements of the record carrier.
9. In a machine of the daracter de-
scribed, the combination with a record sup-port,-a carriage upon which the same is ro- 60 tatably mounted, a rotatable feed screw connected with the said carriage, a drive shaft with which the said feed screw is connected to rotate, and means connecting the record support in rotative engagement with the said drive shaft, of a stylus carrier, and means in rotative engagement with the said drive shaft for imparting lateral movements of reciprocation to the said stylus carrier.
10. In a machine of the character de- 7 scribed, the combination with record support, a carriage upon which the same is rotatably mounted, a stationary frame having a longitudinal guideray in which the carriage is arranged to slide, a feed shaft journaled in the said carriage and held against relative longitudinal movement with respect thereto, the said feed shaft having a threaded portion, a relatively stationary nut for engagement with said threaded portion, and gearing connecting the said feed shaft with the said record support, of a stylus carrier, and a cam in rotative engagement with the said feed shaft, for imparting lateral movements of reciprocation 85 to the said stylus carrier.
11. In a machine of the cliaracter described, the combination with two elements, one constituting a record support and the other a stylus carrier, of means for imparting feeding movements to one of the said elements with respect to the other, means for simultanconsly rotating the said record support, and an eccentric for simultaneonsly imparting movements of reciprocation to 9 one of the said elements in the direction of the said feeding morements, the said eccentric being connected to rotate with the said record support but at a rate of speed which is a multiple of the rate of speed 100 thereof.
12. In a machine of the character described, the combination with a record support, menns for rotating the same, and means for simultanconsly imparting lateral feeding movements thereto, of a stylus carrier, and means timed in relation to the movements of rotation of the record support. for imparting a pharality of complete lateral movements of rexiprocation to the 100 stylus carrier for each complete rotation of the record support.

> D. HOW.ARD H. IVOOD.

Witnesses:
J. (. Hammann.

Ļain S. Дnpuriws, Jr.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D, C."

## G. H. UNDERHILL.

SOUND REPRODOCING OR SOUND RECORDING MACHINE,
995,390.
Patented June 13, 1911.

G. H. UNDERHILL.

SOUND REPRODUCING OR SOUND RECORDING MACHINE,
995,390.
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6 SHEETS-SHEET 2.


Witnesses:
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# UNITED STATES PA＇LENT OFFICE． 

GEORGE H．UNDERHILL，OF BOSTON，MASSACHUSETTS．
SOUND－REPRODUCING OR SOUND－RECORDING MACHINE．
Specification of Letters Patent．Patented June 13， 1911. Application filed May 6，1905．Serial No．259，107．

To all whom it may concern：
Se it known that I．George H．Under－ mul，a citizen of the United States，resid－ ing at Boston，in the comnty of Suffolk and
Improvement in Sound－Reproducing or Sound－Recording Machines，of which the following description，in connection with the accompanying drawings，is a specifica－ ing like parts．

My invention consists in improvements in sond reproducing or sound recording ma－ chines．

Many features of my invention have a use－ ful application to many different types of such machines．including single record machines，but my invention on the whole is particularly applicable，and is herein ilhs－ trated with reference．to one type of multi－ ple record machine having a phomlity of cylindrical records supported by a linked carrying member．snch records being anto－ matically and successively bronght into re－ the comstrintion of the inside links of thie rppoducing or recording mechanism，the lafter being cansed to antomatically traverse the face of cach record as the same is pre－ sented．

My invention will be best muderstood by refermen to the following deseription taken in comection with the acempanying illus－ tration of ome specific embodiment，white its seppe will be note partientary pointed out in the appended chaims．

In the drawings，－Figruse 1 is a central sertional clevation of a portion of a somul reproxheing machine cmbodying one form of my invention；Fig． 2 is a sishe clevation partly insertion showing the mathine of Fig．I；Fig．as is a plan viow partially hoken away of the marhitue show in ligis． 1 ：mul 2：F゙ig． 4 is an culd ervation of the machine shown in Fig．I looking from the laft；Fig． 5 is an clevation of the malerly ing sproedict． whed driving shaf meranged onf the exthe：
 1 throngh lardi of s．pace ；l゙igs，of and 7 ：slonif ill side vieve
 He le．ft in！ligs．I and ：3：ドめs． 8 and！！show
 ：at the right Figss 1 mul 3：F゙igs． 10 mon 11 wre details showing in side elevention the
sound box clutch controller in its clutched and unclutched positions respectively：Fig． 12 is a sectional elevation showing the con－ struction of the sound box carriage and the return screw；Fig． 13 is a rertical section showing the depending sliding shoe at the end of the phate：Fig． 14 is a plan view in section on the line $14-14$ of Fig．13；Fig．15 is a similar but fragmentary biew showing the depending shoe during its return move－ ment；Fig． 16 is a sectional elevation how－ ing the shoe in a position corresponding to that slown in Fig．14：Fig． 17 is a section showing the shoe in elevation in a position corresponding to that shown in Fig．1．s ：and． Fig． 18 is a section on the line 18－18，in Fig．2．slowing the constraction of the mit which engages the somd box return screw．

In the drawings for illustrative purposes I have shom the rarions features of my invention emborlied in a mulliple record phonograph having（ Figs． 1 and 2 ）as series of record cylinders＂amonaled each upom the linked members of a pair of recored－ carrying chains passing wer the separated sprocket wheels b and b，the latter fixed to rotate with the sprocket driving shat fo： which is momed in the frame（c of the nachine，said remords being bronght one by ome into all operatise position lemeath the
 $7,{ }^{2}$ is given an intermittert hurning move－ ment．

Reforming lime to the momming of the imbivedal records．there is prowded an im－ 90 prowed simple ronstrmetion at－ 1 pport of minimum weight，Dut permitting the con－ traction of the reworld hemer inamers in
 jury to the sathe，an woll as the expansion 95 of the recond without leneming it grasp


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chored or embedded in suitably positioned holes in the hub of the opposite but symmetrically arranged mandrel supports $a^{2}, a^{3}$, the latter being keyed to the record-turning
5 shaft $a^{4}$. Before contacting with the core of the record cylinder $a$, they are caused to bow outwardly at $a^{5}$ into or through radially formed slits in the flanged portions of the supports $a^{2}, a^{3}$, which slits act to space and yiellin the wh yielding thereof under contraction of the record.
The record when slipped over the mandrel is self seating aud will be firmly held there-
15 on irrespective of its position and whether pushed on entirely or partially. This construction permits the record to be pushed to any predetermined position on the mandrel and there effectively retained, this being in where the record must be pushed to a seat upon its tapered support regardless of where that leares the record lengthwise the mandrel. This permits a record to be played in cut and, after withdrawal to be replaced upon the same, or on a different mandrel, always in the same longitudinal position. For the purposes hereinafter referred to, on the pushed to a fived position determined by the out-turned lip $a^{6}$ on the inner flanged support $a^{2}$.

A mandrel constructed as described may with an accuracy sufficient for ordinary purposes, but, if desired, the flanged supports may be made to fit the outer ends of the record core with a small clearance, such, for exphe, as five one thousandths of an inch, so that no greater eccentricity can occur than that allowed by such clearance, which I have found negligible, while this allows for the necessary contraction of the record under changes of temperature.
For the best results, the records are preferably reamed at their inner ends, where they loosely fit the periphery of the flanged supports, to render the outer faces concenavoiding eccentricity in the record itself which I have found a common fault with commercial records.
The record turning shaft at that end which I term the inner end passes through the mandrel support $a^{2}$ and an elongated journal sleeve $a^{7}$ terninating in the suitably notched head $a^{8}$, which latter at the proper time is chutched by the record driving mech60 anism hereinafter described.

The sleere $a^{7}$ is hinged or piroted at $a^{9}$ between the arms of the upturned fork $d^{\prime}$ (Figs. 2 and 6) in the link $d$ of the inner record-carrying chain or that passing over
that the mandrel and its record, when released at the opposite link, can be swoung outwardly about the fulcrum, $a^{9}$ as is shown in dotted lines in Fig. 3.

The outer end of the turning shaft $a^{4}$ is 70 journaled in the sliding collar $a^{10}$, fitting the open mouthed pocket $e^{\prime}$ (Figs. 1 and 8) in the link $e$ of the outer chain, or that passing orer the sprocket $b^{\prime}$. The collar $a^{10}$ has a beveled shoulder $a^{11}$ which bears against the correspondingly shaped inner face of the pocket $e^{\prime}$, being forced against the same by the pressure of the spiral retaining spring $a^{12}$ acting through the washer $a^{13}$. The berel of the shoulder $a^{11}$ upon the collar $a^{10}$ is such that when the latter is seated in its pocket it is firmly held there by the spring $a^{12}$ and the mandrel is securely held in accurate alinement upon the chain carrier. If the overlying end of the turning shaft $a^{4}$, which can be readily and manually seized, is lifted a way from the link, the beveled collar will smap out of its seat and the mandrel can be swung outwardly clear of the link $e$ for withdrawal of the record. The sleeve $a^{14}$, pinned to the shaft $a^{4}$ permits the collar a limited morement only, so that after effecting the desired change. when the shaft is again moved toward the link, the collar easily snaps into the pocket. Changes in the records will of course ordinarily be effected when the record is in an inoperative position, away from its position of engagement with the sound reproducing mechanism D .

The collar $a^{10}$ and the washer are made in 100 separate pieces, as shown, for the purpose of retarding the rotation of the record by the friction of the engaging surface of these two parts sufficiently to avoid a rotary movement of the record under its own inertia.

The successive links of each chain are constructed alike, each link being forked at one end to receive the end of the next adjacent link, to which it is pirotally secured by the pirotal tie rods $f$, which pass entirely through from one chain to the other. Each sprocket is provided with four projecting teeth $b^{2 x}$ (Fig. 2) which are suitably notched to receire the tie rods $f$, so that each link is supported by its sprocket at two points through engagement of the tie rods $f$ therewith and through engagement with such tie rods only.

Referring again to Fic. 1, the record driving ar turning mechanism is carried upon the sleere $g$, suitably journaled in the frame C and given a constant rotary movement throngh the belt $g^{\prime}$ and the pulley $g^{2}$, the latter secured to the said sleeve to drive the sarac. The mandrel driving shaft $\pi^{3}$ which is clutched to the mandrel to drive the same, is slidably mounted within the sleeve $g$ and is pimed at its outer end to a grooved collar $9^{4}$. Novement is communicated from the driving sleere $g$ to the mandrel driving
shaft $g^{3}$ through the hollow coupling $g^{5}$ secured to the outer end of the said sleeve and provided with an internal key-way, with which engages a key $g^{6}$ upon the grooved
5 collar $y^{4}$, permitting sliding movement of the latter while causing the rotation of the mandrel driving shaft $g^{3}$. The opposite end of the driving shaft $g^{3}$ is provided with a clutching head suitably notched to engage
10 the correspondingly projecting head $a^{8}$ of the mandrel shaft $a^{4}$ when in the position shown in Fig. 1, but adapted to be withdrawn into a pocket formed in the end of the said sleeve $g$ when the collar $g^{4}$ is drawn
15 outwardly to uncluteh the mandrel shaft $a^{4}$ and permit the sprocket wheels to turn for shifting the records.

I have found a marked improvement in the quality of the somed reprocluction when
20 the rotative movement of the record is perfertly uniform and this I have also fomed can be attained by increasing the mass of the parts to give a fly wheel effect thereto. To this end I preferably make use of the
25 balance wheel ! $f^{8}$ of relatively great mass compared with that of the record and here shown secured to the driving sleeve $g$ to rotate therewith and impart thereto a steadiness and miformity of movement.

It each shifting of the records it is necessary that the record carrier shomld be posidicely and corvectly alined with reference to the somud reproducing mechanism and I have therefore provided the mathine with locking and ammg means comprismg the locking pin / (Fig. 1), which is adapted to anter one of the fon propery positioned holes $h^{\prime}$ (Fig. 2) in the sprocket when the laller is turned to bring a fresh record in 40 its correct position and there lock the same matil the pinh is again withdrawn. The pin! $h$ is carred (Fig. :3) by the herimental swinging locking har $h^{2}$ pisoted to the frame of the machine, the device $h$ being presseed towatd the face of the sprocke by the pressurce of the leaf spring he acting against the bal $1 h^{2}$.

Pressing against the bar $h^{2}$ (Fig. 1) is the horizontal sliding rod $h^{3}$ erontacting at its omer end with the side of the molight
 and pressiod constanlly agrainst the rod $h^{3}$ Dy He adjustable spimal temsion spring h"。


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shaft and effecting at the same time the turning of the sprockets to shift the records. This operation may be effected in a great variety of ways, bit as illustrative of one cmboriment of my invention. I hare shown the electromagnet I located beneath the sprorket shaft. On the completion of the playing of a record the electro-mannet is cmorgized throngh means hereinafter deseribed, cansing the attraction of the armature $i$ attached to the sliding rod $i^{\prime}$, the said amature being normally held away from the poles of the magnet by the compression spring $i^{2}$. This causes the opposite (and of the sliding armature rod $i^{\prime}$ to contad with the upright lever $h^{\top}$ piroted on the machine frame at $h^{8}$ and to swing the free end of the upright lever against the hori$\%$ (ntal locking bar $h^{2}$ causing the withWrawal of the latch $h$ from the sprocket and (alusing at the same time the ontward movement of the sliding rod $h^{3}$ against the vertical swinging lever $h^{4}$ simmlaneonsly to unclutch the driving shaft $y^{3}$ and free the manWer preparatory to the movement of the 9 sprocket.

Referring now to Fig. s the lower end of the upright lever he leats against a flange on the rotary sleeve $i$ pinned to but slidable (1) the shalt $i^{\prime}$, which is jommaled in the mathine frame beneath the magnet I and is given a constant rotary movement byeans of the wern gear $j^{2}$ and the worm $i^{3}$, the lattor beine driven ley the pulley $j^{4}$ aser which pases. the belt !f" (anried to and driven hey a spling motor (not shown) or : my other suitable somere of motive power. Whan the lever $h^{\top}$ is swme abont its fulcmm low ere gi\%ation of the magnet as desmibed. its lower end forses the theme (o) the right as mewed in Fig. ataninst the opmoner mesan: of the spring formsing the foothed
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 of the whtelo diske to rotate the werbatad
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rect position and at the same time releasing the lever $h^{\top}$ to permit the unclutching of the disks $j^{6}$ and $j^{7}$ which follows under the action of the spring $j^{5}$, and also releasing 5 the swinging arm $h^{\ddagger}$.
During the shifting of the records the stylus which has been automatically lifted from the face of the record, is traversed back to its initial position and again the beginning of the record groore.
The sound box D may be of any suitable construction being provided with the usual diaphragm and attached strlus K , the latter groove. The sound box D is supported at the end of the horizontal arm $k$, which is pivoted at $k_{2}^{2}$ to the sliding sound box carrier $k^{3}$. the latter (Figs. 2. 3 and 12) being slidable along the rod $l i^{t}$ at the rear of the machine. The carrier $k_{0}^{3}$ is traversed in its adrance or reproducing morement byr means of the forwardly projecting horizontal arm $l^{2,5}$. attached to the carrier and provided near which engages with the upper face of the finely threaded screms $l_{i} 0^{\pi}$. The feed screts $k k^{\pi}$ is coustantly rotated to adrance the strlus when the nut $k_{0}{ }^{\circ}$ is in engagement with said screm by means of the gear $1 i^{\circ}$ (Figs. 3 and 4) secured at the end thereof and outside the machine casing: the gear $k^{s}$ being driven through the idler $70^{\circ}$ and the driving feed pinion $k^{10}$; the latter (Fig. 1) being mounted directly on the driving sleeve $g$.

The sound box is given an adjustable spring support upon the arm $l_{i}{ }^{5}$ through the intervention of the spiral spring $/ 0^{111}$. The latter rests upon the arm $k^{5}$. about the threaded stud $l_{12}^{12}$ and is carried in the hollom cap $k_{1}^{13}$ which is adjustably threaded into the arm $k$. wherebr turning of the cap will adjust the sonnd bor relativelr to the arm $7_{i}^{5}$. A forked guiding piece is secured to the arm $7^{5}$ and with its upturned ears embraces the arm 7 : to prevent lateral displacement thereof.
When the sound box reaches the end of the record it is automatically lifted, as will be described. and this causes withdrawal of the nut $l_{i}^{6}$ from the feed screw $l_{i}{ }^{\top}$. the stoppage of the advance feed and at the same time the engagement of the depending se $\underline{-}$ mental nut $\eta_{12}^{15}$ with the coarse threaded return feed screw $k^{1,26}$ at the rear of the macline and beneath the carrier shaft $k_{i}{ }^{4}$. The nut $k_{125}^{2.2}$ (Figs. 2. 12 and 18) is secured to the overhead colliar $l^{127}$. fast to the sleeve or bushing $k^{138}$. slidable along the slaft $k^{4}$ and loosely fitted within the carrier $z_{i}^{3}$.

The normal position of the mit relatively to the carrier $k^{3}$. which is shown in Fig. 2. is maintained by the spring pressed pin $k^{10}$. the pointed end of which fits a correspondingly shaped depression in the opposing face
of the collar, the berel of the pin point, howterer. being such that the carrier may be turned relatively to the collar and the pin suapped amar from its seat, thus permitting the sound box with its arm and feeding nut $k^{6}$ to be swung upprard and backward out of the way for inspection of the machine or for ant other purpose, Thile still leaving the nut $k^{i 5}$ depending in the position shown in Fig. 2. When the sound box is swung forward again into position. a positioning arm $l_{i=0}^{20}$ also depending from the collar $l_{i=10}^{C T}$ holds the latter in substantially its normal position until the pin $k^{17}$ snaps into its seat in the collar.
The spring-pressed pin $k^{10}$ also assists in enforcing engagement of the nut $l_{l^{25}}$ with the return feed screm $l_{2}^{110}$, for. if the threads of the scretr are not in such a position as to permit the nut to drop into the same when the strlus is lifted from the record, the pin 7.10 is forced against its spring and the pressure thereof tends to force the uut into engagement as son as the scrett turns far enough to permit this.
The coarse threaded return feed screm $77^{125}$ is given a movement the reverse of the ad-
 tween the gear $k^{k^{2} 1}$ (Figs. 3 and + ) fast upon the screw $l_{2^{10}}$ and the gear $l_{i}^{8}$ upon the adrance feed screw $l^{\circ}$.
Ln important feature of my invention is the provision of means whereby the strlus maly be dropped into the first groove at the commencenent of reproduction and whereby this is accomplished with each of the records of the series irrespective of differences in the cutting of the recordz. also in the prorision of means for raising the strlus from the record immediately after the last note is played and with each record of the series. This not only insures the elimination of the hissing noise ustrally preceding and following the playing of a record, but also a aroids the umecestary lapse of time between the playing of the records.

The controlling device for dropping the strlus on its return morement at the appropriate time and place is carried by a swinging stirrup 7 (Figs. 1 and 13 to 17) extending across the machine and piroted by its upturned ends to the frame thereof. To this :tirrup is sccured the guide plate $l^{\prime}$ of $a n \mathrm{~L}$ shaped section haring the upturned lip $7^{2}$ and supporting the sliding controlling plate $7^{3}$. the latter having a straight vertical front edge $7^{*}$ for a greater portion of its length. but terminating at one end in the bereled recessed portion $l^{7}$.

Fixedly secured to the feeding arm $k^{5}$ is the depending controlling shoe $7^{6}$ so positioned that during the adrance of the strlus the straight edge of the controller plate $7^{3}$ lies against the side of the shoe near its lower edge, as shown in Fig. 17.

When the stylus reaches the end of the record, however, and is lifted, the shoe $l^{6}$ is raised clear of the plate $t^{3}$, and the latter, carried by the swinging stirrup gravitates
5 beneath the lawer erlge of the shoe so that when the stylus is released by the lifting mechanism the shoe is deposited and caused to return upon the upper face of the plate $l^{3}$ near its outer edge, the sound box being
10 thereby sustained at such an elevation as to canse the stylus to clear the record and the nut $l^{6}$ to be discngaged from the advance feed serew $1 \mathrm{he}^{-}$. At the instant when the shoe reaches the recessed portion $l^{5}$ upon the
15 plate it drops into such recessed portion (see liigs. 14 and 16), lowering the stylus, disengaging the mit $h^{15}$ from the return feed sctew, and again starting the advance of the reproducing mechanism. The advanced
20 edge of the shoe is beveled to correspond to the bevel $l^{5}$ upon the plate and as the shoe adrances with the sumd bor it swings the plate with its stirrup, back from the position shown in Fig. 14 to that shown in Fig. 15,
25 so that it assmmes the position shown in Fig. 17 during the reproduction of the record. The position of the sliding plate $l^{3}$ therefore detemines the dropping of the stylus and this 1 have rendered antomati30 cally adjustable with respect to the commencement of the record groove in each individual record of the serices so that whereever the growe starts relatively to the end of the reeord the stylus will there be dropped
35 and at 110 other place. This is effected by the $V$-shaped controller positioning device $m$ having a flared apening positioned approximately in the path of travel of the outturned end of the series of pins $m^{\prime}$, the latter
40 being aljustablly secured to the upright arm $m^{2}$ "pen each of the record-carrying links d (Fig. (;). The pin $m^{\prime}$ may he secured in its link loy any suitable means, as loy the set serew ma $^{3}$ and there acemately adjusted with
45 referene (o) the emmencement of the somud growe of that recom which is carmed by the next sureceding link. As the records are shilter, the positioning pin upon the link whicl? is carrying its recond ont of operative
so presition is eansed to sweep) thengh the Hated oproning of the positioning device and rember the satid deviee in its line of tated, Haceroly pensitioning the controlling plator $\boldsymbol{p}^{3}$ sor as io drop) He stylus ceate fly in lle com5.5 memement of the growe al the next meded.

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60 of emon rexod when the lather is prexmed (1) the somal repronlucing meenaniom, ir resuedive of ranaliens in the emtling of the difterent renode amb, mo maller lan oftern
 35 from and rephated ngoon heir mandrels.

In the illustrated machine there is provided not only the described means for dropping the stylus into the first groove of the record, but also for dropping the stylus into
the beginning of that groove. For this purpose the records advancing toward the operative position are held against rotation by mandrel-locking means and presented to the stylus with the begimning of the record groove directly bencath the line of travel of the stylus, the lock being then withdrawn to permit rotation of the record, which follows as soon as the styhus is lowered.

The mandrel locking means comprises a locking pin $n$ (Figs. 3 and 7) carricd by the $\varepsilon$ link $d$ and adapted to enter a locking recess $n^{\prime}$ in the immer face of the flanged mandrel support $a^{2}$. The pin $n$ is slidably momed in the upright member $u^{2}$ of the link $\downarrow$, being pressed toward the mandee by the leaf spring $n^{3}$. The locking pin $n$ is withchawn from the mandrel as the record reaches its uppermost and operative position, by the forked end af the bell crank lever $n^{4}$ piroted to the side of the link. the witholrawal of the link being effected by contact between the opposite spherical end $n^{\text {n }}$ of the lever arm and the muder face of the stationary cam $n^{6}$ (Figs. 1, 4, 10 :and 11) secured to the imer side of the machine frame. Is the record moves into operative position, the spherical head rides upon the cam, cansing the later to withetaw the locking pin and free the mandrel for rotation, the latter, however. being still positioned against aceidental movement ly the friction between the collar $u^{11}$ and the washer $u^{13}$.
The mandrel is provided with a reference or index mark, such as tho moro mark, ui (Fig. a) : and each record after being ent, is 205 provided with a corresponding reference mark $n^{*}$, alining with the beginning ol the record groowe. The mandrel inder marls is so located with reference to the lowking recerss $n^{\prime}$ that when the reeord is pmathed 11 pom thes suppert with its wefene mark registering with the reference mark mpon the matrNed, the locked mandred will hring the tive pat of the groowe directly bemeath the line of trated of the stylus.

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Tha timing of the men whants in prafor ably suld thint the recolal shifting is com



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ping point howerer far from the initial position of the record its groore begins. In order to prevent the record from being turned during the interim, I have provided
5 the slidable locking plate o (Figs. 1, 10 and 11), Which prevents the clutching movement of the driving shaft $g^{3}$, even though the latter be released by movement of the locking bar $h^{2}$, until the stylus is dropped for enslotted to slide with a limited movement upon the pins $o^{\prime}$, and has an opening $o^{2}$, which in the lomermost portion of the plate registers with the clutch head $g^{\top}$. The plate
1s o is normally pressed upward, and toward the position shown in Fig. 11, by the spring $o^{3}$, located between the frame of the machine and the overturned end $\sigma^{4}$ of the plate, but is pressed downward into the position shown
20 in Fig. 10, by the overhanging lug $o^{5}$, upon the sound box D , when the latter is lowered as indicated in Fig. 1. When the clutch head $g^{7}$ is retracted to release the mandrel preparatory to the shifting movement, the head in its pocket from which it cannot emerge until the plate is pushed downwardly by the weight of the sound box as the stylus is lowered. When the stylus
Bu drops into the record groove, the released clutching head engages the mandrel and the latter, on account of the relatively great inertia of the fly wheel $g^{9}$, immediately assumes the uniform speed of the latter.

To withdram the stylus from the record. the sound box D is provided with the overhanging extension $p$. to the adranced face of which is secured the depending plate $p^{\prime}$ (Figs. 1 and 3), the lower edge of the latter $p^{2}$, one of which is carried by each of the outer carrying links $e$. Is soon as the shifting morement of the sprocket begins, the lifting pin, which has a line of travel indicated by dotted lines in Fig. 2. meets the lower edge of the plate $p^{\prime}$ and raises the stylus, the controller plate $7^{3}$ thereupon swinging under the shoe $l_{1}^{6}$ : After the sprocket is turned and the pin withdrawn 50 from the plate $p^{2}$, the shoe $l^{6 i}$. resting upon the controller plate, supperts the sound box during its return morement.
In order that the record shifting movement, and, therefore, the withdrawal of the completion of the last note of the record, the tra veling sound box is provided (Figs. 2 and 3) with the depending stop finger $r$, which, just before the completion of the record, is caused to meet the end of the adjustable and yieldable stop pin $r^{\prime}$. The latter (Figs. 8 and $3)$ is threaded into the lifting pin $p^{2}$ and slidable in a head formed upon the upright arm $r^{2}$ at the rear end of the link $e$. The pin $r^{\prime}$ is normally pressed outward, as shown
in Figs. 3 and 9, by the spring $r^{3}$, but, when engaged by the finger $r$, is moved with the sound box to cause contact between the lifting pin $p^{2}$ and the stationary contact pin $r^{4}$, attached to but insulated from the frame of 70 the machine. The stationary contact is connected through circuits (unnecessary to show) with the magnet I and a suitable source of current, the other terminal of the circuit being grounded to the frame of the machine, so that, on contact between the contact $r^{4}$ and the pin $p^{2}$, which latter is of conducting material, the circuit is completed and the magnet energized for starting the shifting movement, as has been described. Upon withdrawal of the pin $r^{\prime}$, the latter again assumes the position shown in Fig. 3, thereby deënergizing the magnet.
The threaded adjustment of the pin $r^{\prime}$ within the locking pin $p^{2}$, permits the adjustment of the former with reference to the termination of the record groove in each individual record, so that the closure of the controlling circuit will take place at the proper instant in the travel of the stylus to withdraw the latter from the record when the last note has been played.

In the machine described the playing of the records follow one another rapidly in succession with no other interral than that required for the return of the stylus. The coarse threaded screw shomn may be relied upon to return the stylus with sufficient rapidity for ordinary purposes but my inrention is not necessarily limited to the specific form of stylus return mechanism shown and if a still quicker return is desired other means for effecting this may be employed.

It will of course be understood that many features of my invention herein described are applicable to types of sound reproducing or sound recording machines other than the one which is here taken for purposes of illustration, and that such features of my invention either modified or as clescribed, may be applied to such machines without reference to the presence or absence of the remaining features of said invention. It will also be understood that while I have described with considerable detail for illustrative purposes one practical embodiment of my invention, the same is not limited to the details described, or the form, relation, or construction of parts, but that many and wide modifications may be made therein without departing from the spirit of my invention.

It is also to be understood that, while the illustrated machine employs a traveling stylus with a stationary record support, and adjustment of the engagement between the stylus and the record is attained by adjusting or regulating the movement of the stylus, the reverse of these relations and conditions, as well as variations and modifications in the
means by which the object is attained, are within the scope of my invention; it being obvious, for example, that the stylus might remain stationary and the record caused to 5 travel.

Furthermore, although the machine illustrated is capable of and may be employed for regulation of the stylus movement to engage the record at the beginning of the groove
10 thereof and withdraw therefrom at the end of the groove, my invention is not limited to the attainment of that precise condition; the engagement with the stylus may occur before the beginning of the groove and disen-
15 gagement take place after the ending of the groove, it being within the scope of my invention to regulate the action of the stylus upon the record in any desired way with reference to the character of the groove in20 pressed thereon.

I claim-
flyhure

1. A multiple record sound - reproducing machine having means providing for a perind of stylus engagement with the individ-
25 url records proportioned in each case to the length of the sound groove therein.
2. A multiple record sound -reproducing machine having means providing for a perid of stylus engagement with the individ-
30 hal records thereof automatically propertoned in each case to the length of the respective records.
3. A multiple record sound -reproducing (machine employing a stylus and having a
35 stylus controller, means for presenting to the stylus in stnecession the individual records of the machine, the control of the stylus by the said controller being dependent nipa the location on the record of the beginning
40 of the recon el groove or impression.
4. ad maniple record sombl-reproducing machine employing a style and having a stylus controller, means for presenting to the stylus in succession the individual rends of
45 the machine, the control of the stylus by the said controller being dependent upon the location on the record of the curling of the record grove or impression.
5. A multiple record somad-reproducing

50 machine employing a stylus and having a sty las controller means for presenting to the styles in sureression the individual reedele of the machine, the emote of the stylus being deponent nom the differing character of
55 the record groove of inhesion in the reerective records.
(f. A multiple remand sombl-wproducing machine having mons for throwing the style in :my ont of chgagement with the
 with faliweme (a) math mona for mating engagement thereof at the begriming of the rand grow se.
7. A multiple wood samblepmodneing 65 mimehime having means andomationlly (o) ant-
just the engagement of the stylus with the separate records with reference to the beginming of each record groove.
8. A multiple record sound-reproducing machine laving a record-carrier, a stylus, 70 and means upon said carrier for each of the several records there of to determine the travel of the stylus for its respective record.
(1) A multiple record sound-reproducing machine having a stylus and islljustable stylus-controlling means for each of the seraral records thereof.
10. In a multiple record sound reproduceing machine the combination with a movable record carrier of means for causing the with- 86 drawl of the stylus from the record on movement of said carrier and means adjustable for individual records for setting the carrier in motion.
11. In a reproducing machine having a 85 movable record carrier for bringing sacessive records into position, means depending upon the character of each individual record for moving the carrier.
12. In a multiple record sound-reproduc- 90 ing machine, the combination with a mo rable record-earrier, and means for the seraral records adjustable each with reference to the ending of its respective record groove for setting sad carrier in motion.
13. In a multiple record sound-reproducing machine, the combination with a mowable record-carrier, of means for causing the withdrawal of the stylus from the record on movement of sad carrier, and means for 100 each record thereof adjusted with reference to the cud ling of its record groove for setting the said carder in motion.
14. In a multiple record soul -reproduceing or somul-recording machine, the combs- 105 nation with at style, a plumate of rotatable records, and means for presenting earth mexace for sultersive engagement with the - who in a predelerminal position upon it silpport.
15. A multiple record som bl mporducing machine has wing a plurality of rotatable mexards adapted for successive engagement with
 mans low holding the records agnation rota- 115 ton prion (1) "ngngement with the sum ed mproducing mechanising.


 fiche, and means for antomatheally relearn ing the -ate for rotation.
 (1) somm-remeding machine hathige a pho


 With the :lylls.
 mach inc having a patly of rotatable med $1: 0$
ords, means for presenting each record for successive engagement with the stylus in a predetermined position upon its support, and means for restoring the record to its
5 predetermined position before reèngagement with the stylus.
19. A multiple record sound-reproducing machine having a plurality of rotatable records, means for locking the sereral rec-
10 ords against rotation prior to engagement With the stytus, means for releasing the same. and means for re-locking the said records

I 20. A multiple record sound reproducing machine haring means for automatically rarying the position of stylus engagement for successive records.
21. A multiple record sound reproducing machine haring means for automatically
20 rarying the position of stylus disengagement for successive records.
22. A multiple record sound-reproducing machine having means for varying in consecutive records and with reference to the the position of stylus engagement or disengagement on the record, and means for presenting to the stylus in succession the indiridual records of the machine.
28. A multiple phonograph having a record carrier for shifting the records and means movable with the carrier for controlling the record shifting morement of the carrier.
29. A multiple phonograph having a
linked record carrier and adjustable means for controlling the shifting movement of the records upon the links thereof.
30. A multiple phonograph having a Łinked carrier comprising pairs of oppositely arranged links, a hinged record support upon one link and an open-ended pocket in the opposite link.
31. A multiple record sound reproducing or recording machine, having a plurality of record supports, a fly wheel and means for attaching the fly wheel to and detaching it from the indiridual record supports.
32. A multiple record phonograph having a plurality of skeleton record supports, driving means, and a fly wheel connected with said driving means and adapted to be connected to and disconnected from the individual record supports.
33. A sound reproducing machine having 85 a sound box, means for adrancing the sound bex and means for returning the same, and a yieldable comection between-said adrancing and return means.
3t. A sound reproducing machine haring 90 a sound box, an adrancing feed screvs, a return feed screw, a member attached to said sound box engaging said adrancing feed screw, another member also attached to said sound box for engaging said return feed screw, and a jieldable comnection betrreen said members.
35. A sound reproducing machine haring a traveling sound box and a stringing support therefor attached to the machine and means aftached to said sound box for engagement with said support, said support being adapted to swing beneath said engaging means when the sound box is lifted.
36. I sound reproducing machine having 105 a sound box and a sminging gravity actuated support for said sound box adapted to act nithen the sonnd bos is lifted.
37. A phonogiaph having a stylus, a controller comprising a sliding controlling plate and a swinging support therefor.
38. A multiple record sound-reproducing or sound-recording machine having means for throwing the stylus in and out of engagement with the record, means for presenting successive records in operative relation to the stylus, and differential means for causing engagement of said stylus with the successive records at the beginuing of the record groore and disengagement therefrom at the end of the record groore.
39. I sound-reproducing machine having sound-reproducing mechanism, means for presenting to the said mechanism a succession of records, and differential means for disengaging the sound-reproducing mechanism in each case from the record at the end of the record groove.
40. A sound-reproducing machine haring sound reproducing mechanism, means for
presenting to said mechanism a succession of records, and differential means for engaging said mechanism in each case with the record at the beginning of the record
41. A multiple record sound reproducing machine having a plurality of records, each provided with an identifying mark, a mandrel having also an identifying mark wherea record may be placed thereon 111 a predetermiued position, a stylus, and means for presenting said records in succession to said stylus, means for lowering the stylus upon the record, and means for simultaneously starting the rotation of the record.
42. A multiple record sound reproducing machine having a plurality of xecords havino each an identifying mark placed for the determination of the beginning of the recagainst rotation prior to the engagement of the stylus therewith, and means for presenting said records successively to the stylus.
43. A sound reproducing machine employing a grooved record, a traveling sound bas provided with a stylus, means for lowering the sound box and stylus at a point determined with reference to the beginning 0 of the record groove, and means for presenting the record for engagement with the stylus in a predetermined position upon its support.
44. A multiple record sound reproducing 35 machine having sound reproducing mechanism, a plurality of records, means for presenting them successively to the action of the sound reproducing mechanism, means for holding each record against rotation
40 prior to its presentation to the sound reproducing mechanism, and means for releasing the same prior to the engagenent of the somid reproducing mechanism therewith.
45. A multiple record sound reproducing

45 machine having a stylus, a plurality of rece ords, means for presenting said records successively for engagement with said stylus, and means to cause disengagement of the stylus from the records at variable points in 50 the path of stylus travel.
46. A milliple record somed reproducing
machine having a stylus, a plurality of records, means for presenting said records in succession for engagement with said stylus, and means for calusing engagement of the 85 stylus with the successive records at variable points in the path of stylus travel.
47. A multiple record sound reproducing machine having sound reproducing mechanism, a plurality of records, and means for presenting said records in succession for engagement with said sound reproducing mechanism, said mechanism including a stylus having a variable length of travel.
48. A multiple record sound-reproducing 65 machine, having a traveling sound box, means for advancing said sound box, means for holding said sound box in a position to disengage from said-advancing means for its return movement, and means for changing the position of said holding means to vary the time of stylus engagement with the different records.
49. A multiple record sound-reproducing nachine, having a traveling sound box, 75 means for advancing the said sound box, a controller for holding the said sound box out of engagement with its advancing means during return movement, and means for adjusting said controller to vary the time of

[^3] engagement with the adrancing means for the different records.
50. A multiple record sound reproducing machine employing a stylus and having a stylus controller the application of the stylus to the record by the controller being dependent upon the location on the record of the beginning of the record groove or impression.
51. A mulliple record sound reproducing 90 machine having a plurality of records, a styhus, and means for varying in consecutive recoteds and with reference to the charaterof suceessive sound records the time of application of the stylus to the record.

In testimony whereof, I have signed my name to this specification, in the presenere of two subscribing witnesses.
(FEORGEH.UNOERHHA」。

## Witnesses:

Thomas B. Bootit,
Eиemeit S. Emerr.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
G. JUNGREN.

SOUND RECORDING AND REPRODUCING MACHINE. applioation filen feb. 27, 1905.
995,680.
Patented June 20, 1911. 3 sheets-sheet 1.

$\qquad$
G. JUNGREN.

SOOND RECORDING AND REPRODOCING MAOHINE.
APPLIOATION FILED FEB. $27,1905$.
995,680.
Patented June 20, 1911.
3 SHEETS-SHEET 2 .

Fis. 4.


Fis 5.


Witnesses:
Inventor:
E. m. Boced. agusten fungreny ferfrationg.
G. JUNGREN.

SOUND RECORDING AND REPRODUCING MACHINE. APPLIOATION FILED FEB. 27, 1905.
995,680.
Patented June 20, 1911.
3 SHEETS-SHEET 3.


# UNITED STATES PATENT OFFICE. 

GUSTEN JUNGREN, OF ST. PAUL, MINNESOTA, ASSIGNOR OF TWO-FIFTHS TO FREDERICK G. BRADBURY, OF ST. PAUL, MINNESOTA.

SOUND RECORDING AND REPRODUCING IVACHINE.
995,680.
Specification of Letters Patent. Patented Jume 20, 1911. Application filed February 27, 1905. Serial No. 247,625.

## To all whom it may concern:

Be it known that I, Gusten Jungren, a citizen of the United States, residing at St. Paul, Ramsey county, State of Minnesota, 5 have invented a new and useful Sound Recording and Reproducing Machine, of which the following is a specification.
My invention is a sound-recording and reproducing machine, in which a musical com-
10 position or other combination of sounds is recorded in plural and unlike or similar parts or portions on phural recording surfaces, one surface for each part. These parts or portions of the record are then repro-
15 duced at the same time and together so that the corresponding elements of tone and rhythm in them coincide making the effect like that of the original production.

The object of my invention is to give more
20 volume, clearness and strength to the reproduction of sounds and also to bring out the musical harmonies more fully than can be done by the method now in use of recording the sounds on one surface only.
25 In the accompanying drawings, Figure 1 is an elevation of my invention, partly in section along the line $\mathrm{Y}-\mathrm{Y}$ (Fig. 2) ; Fig. 2 is a top phan, showing the sound conveying tubes partly broken away; Fig. 3 is a
30 section of the upper end of one of the tubular ams, supporting a sound-box; Fig. t is a side view of Fig. 1; Fig. of is a view similar to Fig. 1, with the sombd-boxes spread apart ; Figer of is a plan of my invention with
35 a single amplifying horn, and Fig. 7 is a side elevation of the construction illustrateal in Fig. (j.

Theere drawings and the following detailed desseription relate to a style of my 10 invention wherein only two disk-sinfacess are ned for the recording : and reprothecing simmbanemsty of the musiral romposition or wher rombination of sommes selerted. The somed waves from the original produc-
45 tion ane divided into fwo parts and by means of recciving fimuels on horns, comvered to
 simfaces, one part on bach surface, saicl sme fares being of the same size and wotating at
50 exarly the same spered, one fiom left to right, the other from right to left and presonting a material, atal othere comblitions, faromala for and asmally rmployed for the Perselling of somuls. Thase two pats on 05 hallere, together entitating the reemel in
full of the selection are then reproduced at the saine time, the corresponding elements of tone and rhythm in them simultaneously, so that the effect will be like the original production. The recording of the two 6 parts of the record may be done upon the surfaces of two separate disks of equal conditions as to size, speed, etc., the two parts, in the duplication of the first record may be transferred later upon the two surfaces of one disk, corresponding convolutions of the spiral sound-groves and the elements of sound therein exactly opposite each other; or it may be done at once upon the two faces of one disk which will then constitute a master record from which others may be duplicated. The two parts or halves of the record may be made similar or unlike, phonetically, and I do not wish to limit myself to either of these two altermatives but I prefer an arrangement whereby dissimilar parts of the musical composition or other combination of somuds selected are recorded upon the two surfaces. Such an arrangement enables me to bring out the varions parts more distindly and ummixed thus rendering the masical harmonies more clear and like those of an original production. 'The following is a brief description of such :ln arrangenent: 'The performers of the sommes to be recorded and reprodnced must all perform at one and moder the manal comlit ions for recording somms 11 pon disk-simfinta; only that they are divided into two gromps within hearing distance of each other so that the selection may be well remblemed as to rhythu, expression, and so forth, but fur chongh apayt so that the sombl wase from each of these (wor gronps maty be gathered and comeerol, hy means of rededing homs. to two di-k-sulitates in the spirnt somme grooves of which they : are rewnded, withont Wecing in as great dagre comminglod with the vibuatimis fiom the where parm. In the Eromping of the performers thee powho Thes somals masily alikis as (10 pitch. whame. and -a forth, shaind be placed together: In

 hasses on the wher: if a mal dhet. the hight voice mus be placed and wemeded ont the one surface, the lower pithod mice on the wher, med the metompaniment with the


gether to the one surface, the basses being recorted upon the other and so forth.

In the accompanying drawings, A represents a disk-record conforming to the abore in two parts, a record of a musical selection.
C D are berel gears transmitting the motion from the motor (not shown) in the cabinet N to the turn-table B , onto which frame, secured to the top of the cabinet and having journal bearings for the two shafts of said bevel gears.
$\mathrm{E} \mathrm{E}^{\prime}$ are two sound-boxes of ordinary

15 needle-points exactly opposite to each other on the two surfaces S $\mathrm{S}^{\prime}$.

F $\mathrm{F}^{\prime}$ are two tapering tubular arms receiving and supporting the two sound-boxes so as to hold the sound-boxes in the proper position to the disk-surfaces. The sound vibrations from the sound-boxes are conreyed through the tubular elbows formed by
25 the attachment of the tubes $\mathrm{C}^{\prime}$, at right angles to the arms F $\mathrm{F}^{\prime}$, and then through the tubular fittings $\mathrm{H} \mathrm{H}^{\prime}$, which are secured to the cabinet by means of the brackets I I', and through the tapering tube $\mathrm{J} \mathrm{J}^{\prime}$; the
30 latter may serve to conrey the sound directly to the auditors but I recognize it as a desirable construction to add a swivel am-plifying-horn $K$ into the smaller end of which the larger terminals of the tubes $\mathrm{J} \mathrm{J}^{\prime}$
35 then should converge. Such horn is shown in Figs. 6 and 7.

The tubular arms $\mathrm{F} \mathrm{F}^{\prime}$, with the tubes C C'firmly joined to them and to soundboxes at their upper ends, are joined tobeing hy mor ormo being shaped so as not to interfere with the interposing disk. press the reproducing-needles against the disk-surfaces. By means of these springs the parts $\mathrm{E}, \mathrm{F}, \dot{\mathrm{G}}, \mathrm{L}, \mathrm{G}^{\prime}, \mathrm{F}^{\prime}$,
$\leq 5$ and $\mathrm{E}^{\prime}$ move together as one piece, which may either slide right and left in the tubular bearings II $^{\prime}{ }^{\prime}$, to compensate for uneven motion in the disk, or swing parallel with the disk as the needle-points move in ward the center, or both. By this means of connecting the tubular arms may be distanced from each other by forcing the springs to spread and thus the adjustment difficulty to orercome in my method of sound-reproduction is to get, with certainty, the two reproducing-needle-points to run at the same time in the corresponding conrolutions of the spiral groores upon the two and replacement of reproducing-needles in the sound-boxes is facilitated.

The cycles of the spiral grooves upon the disk-surfaces being very close together, ninety or more of them to an inch, the main surfaces. This difficulty I overcome in the
following manner: One, or both, of the sound-boxes-for example I will choose $\mathrm{E}^{\prime}$ is morable, in and out, in its tubular supporting arm $F^{\prime}$, by means of a rack $Q$ (Fig. 3) having teeth secured thereto and a pinion, or worm R , provided with a milled head M, fastened upon the tubular arm and working in the teeth of said rack Q . When the needles have been replaced the operator holds the sound-boxes close to the edge of the disk, but disengaged therefrom (this position is indicated in Fig. $t$ by dotted lines) and looking down upon the points of the reproducing-needles, he turns the milled head II, adjusting the two points as nearly opposite as he is able. As this cannot be deemed sufficient for accuracy, for in making of the record, the corresponding cycles of the sound-groores may not have been placed exactly opposite each other on the two surfaces, as intended, I have provided the disk-record, hereinbefore partially described, with a signal prefacing the main record. said signal consisting of numerals, letters, syllables, or words constituting a series of numbers, letters, a word, words or a phrase and recorded in quick succession alternatively upon the two disk-surfaces. For illustration I will say that the signal consists of the compound word "all-right". The word "all" is then recorded upon the surface S and the word "right" is recorded upon the surface $S^{\prime}$. These words need not be loud. merely sufficient to be heard by the operator. As soon as the reproducingneedles engage the somid-groove of the rerolving disk the word "all-right" will be heard provided the needle-points have the proper relation to each other. If the machine calls out "right-all" the operator, being duly instructed as to what the signal should be will understand that the soundbox $E^{\prime}$ engages the record ahead of its companion sound-box E and that it therefore should be drawn back the width of one sound-groore or more. as indicated by the separateness of the two words, by means of slightly turning the milled head M. Again, should the effect be "all-right" the distancing of the words would indicate that the sound-box E is in adrance and hence that $\mathrm{E}^{\prime}$ should be moved in the opposite direction to that in the previous case. By having "one" recorded upon the surface $\$$ "two" upon S', "three" upon S, and
"four" upon $S^{\prime}$ in close succession the purpose in riew may be still easier attained.

An additional adrantage offered by my method of recording and reproducing sounds and adding a new feature to disk-record machines is that the reproduction of the record may be done backward, employing the same mechanism (but for a provision to turn the sound-boxes in their sockets, so as to get the right angle of the needles to the
disk) by reversing the disk upon the turntable and starting the reproducing at the inner, or central, instead of the marginal, ends of the spiral sound-grooves. Records 5 intended to be used in this manner should be provided with a signal, as hereinbefore described, at the close of the record proper, in addition to the marginal signal. The rerersing of records will in many instances
10 caise amusing effects and may give musicians the clue to new melodies and harmonies and afford scientists better opportunities to analyze the principles of sound.

For the convenience of the operator all
15 disk-records for the class of machines as set forth may be labeled in a manner to readily distinguish the two faces from each other:

My invention is applicable to sound-re-
20 cording and reproducing machines, broadly; and while, in producing sounds from a diskrecord of the class hereinbefore described, I deem that the rertical position of the disk, a.s shown, is most advantageous, the method

25 and principle as set forth are also applicable to a horizontal or other position of the disk, with slight adaptation of details in the inechanism. I do not wish, therefore, to be maderstood as limiting myself to the style
30 and arrangement as shown in the accompanying drawings.

I :an not aware of the use, nor invention, prior to mine, of a somud-recording and reprorlucing machine having phural parts,
35 or portions of the same selection of sounds upon phural recording surfaces, said parts recorded at the same time, and reproduced simultaneonsly, in such a manner that the corresponding clements in them coincide;
40 or of a donble-faced disk-record having phonetically milise or similar parts of the same somberecord, one upon each surface to be simmbanconsly reproduced, corresponding clements of somed and thython in them coin-
4E riding; or any mechanism for reproducing sommels from sum disk-records.
What I cham as wew, therefore, and desire to seceme by Letters Jatent, is

1. I somud recording and reproducing

50 machine, comprising a rotatable recond disk, haning sommdrecords upon its opposite laces, and sombl boves having strhses simultanconsly cheaging said somul-records.
$\because . A$ sonmal recosting and reprodncing
55 madhine, comprising a movable recond hat ing somadrecords mpon its opposite fares, mud sommed bexes having slyluses simultaneomely chgating said somad records.
3. Li a machine for reproducinge somel, a

00 remol י!matively expmed on two sides and
 (omprisimg a pair of oppositely disposed reproducers adaphed (10 he simultaneonsly influmed hey salid reword.

1. In combination with a somm record
disk. means for simultaneously subjecting the opposite faces of said disk to sonorous vibrations, for the purposes specified.
2. In a machine for reproducing sound, a flat record operatively exposed on two sides, sound reproducers adapted to simultaneously engage said record on its opposite sides, and means for causing substantially equal pressure by said reproducers against the opposite sides of said record.
3. A machine of the class set forth, comprising a rotatable record disk, having scmend-records upon its opposite faces, sound boxes, having styluses simultaneously engaging said somd-records, and means for cansing a spiral line to be traced on the faces of said disk by the styluses.
4. In a machine of the class set forth, a disk record provided with sound grooves in each of its opposite faces, said grooves having coinciding and dissimilar phonetic parts, and means for simultaneously reproducing somid from said grooves.
5. In a machine of the class set forth, a disk record providel with sound grooves in its opposite faces, each groove recording a part of a combination of sounds, and means for simmltaneously reprodncing sonnd from said grooves.
6. In a machine of the class set forth, a 95
disk record having a pair of somed reprochucing grooves in its opposite faces, means for revolving said record in a vertical plane, a pair of styhses tracing in said grooves, and mems for adjustimg said stylnses to register with corresponding phonctic parts int sald grooves.
7. In a sound recording and reproblucing mathine, a somme record provided with opmsed somm grooves, somm boxes provided with tyhnes condeting with said somnd groove to simultanconsty repronture parts of a combination of sominds, and aphometic signal, rerombed in sald groowes, indiating the retative positioms of saidel styhses.
8. In as smad reroming madhine, a recond disk and simatameonsly promble recorders having points adapted to inserile simul entocese oul the apposite lames of sald disk.

$\qquad$


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$\square$100
$\qquad$
 madhime a mernd disk pronided with sumad growes in its appased faces. somble boses hat ing points manging lhe grooves in said disk, and me:ans for intjusling sald points in 120 caid rontul grooves.
13. In a somad remording and whernabing machince a moned disk provided will somad growes in its opposed fucess somed botes
 and ancans lon indopendent! adjusting satd prints with metation to sntid grootes.
11. In as somul rewording amd reproducing machlume a mored disk provided wilh sumal

boxes haring styluses tracing in said sound groores, means for rotating said disk, and means for adjusting said sound boxes with their points in the sound grooves of said 5 disk
15. In a machine of the class set forth, a vertical turn table for holding a disk, means for actuating said turn table to turn said disk in a vertical plane, means for detach-
10 ably holding said disk on said turn table, and sound boxes having styluses tracing upon the opposite faces of said disk.
16. In a machine of the class set forth, a record disk, having sound-records upon its.
15 opposite faces, means for rotating said disk in a rertical plane, and sound boxes having styluses simultaneously engaging said sound-records.
17. In a machine of the class set forth,

20 the combination of a record disk, having sound-records upon its opposite faces, means for rotating said disk in a rertical plane, sound boxes, having styluses simultaneously engaging said sound-records, and means for
25 amplifying the sounds reproduced by said boxes.
18. In a machine of the class set forth, the combination of a disk adapted to reccive sound-records upon its opposite faces, means
30 for rotating said disk in a vertical plane, sound boxes, having cutting tools simultaneously engaging the opposite faces of said disk, and means for conveying sound to said boxes.
19. A machine of the class set forth, comprising a movable record, having plural sound-records pertaining to the same phonetic composition, arranged to operate together and provided with a phonetic signal,
40 and sound boxes having styluses simultaneously engaging said sound-records.
20. A sound record tablet provided with right and left hand spiral sound grooves and means for simultaneously reproducing sound 45 from said groores.
21. In a machine of the class set forth, a sound record tablet and means for simultaneously inscribing right and left haud somd grooves in said tablet.
22. In a machine of the class set forth, a sound record tablet and means for simultaneously inscribing right and left hand sound grooves in the opposite faces of said tablet.
23. In a machine for reproducing sound, a

55 record tablet operatively exposed on two sides. sound reproducers adapted to simultaneously engage said record on its opposite sides, and resilient means for holding said
reproducers under equal pressure against the opposite sides of said tablet.
24. In a machine of the class set forth, a sound record tablet provided with right and left hand spiral sound grooves in its opposite faces, said grooves including a phonetic signal preceding the main part of the record, and means for simultaneously reproducing sound from said grooves.

25 . In a sound reproducing apparatus, a traveling tablet having a sound record formed on each side thereof, a reproducing stylus shaped for engagement with one of said records and free to be vibrated and propelled by the same, and a reproducing stylus shaped for engagement with the other record and free to be vibrated and propelled by the same.
26. In a machine of the class set forth, a rotatable record disk, having sound records upon its opposite faces, sound reproducers simultaneously engaging said records to simultaneously reproduce from the records upon the opposite sides of said disk and a common amplifying horn connected with said reproducers.
27. In a sound reproducing apparatus, a 85 traveling tablet having a sound record formed on each side thereof, a sound box having a reproducing stylus shaped for engagement with one of said records and free to be vibrated and propelled by the same, a second sound box having a reproducing stylus shaped for engagement with the other record and free to be vibrated and propelled by the same, and an amplifying horn in which said sound boxes hare a common outlet.
28. A sound reproducing machine, including a double faced disk record tablet having sound records upon its opposite faces and sound reproducers simultaneously engaging said records to simultaneously reproduce from the records upon the opposite sides of said disk.
29. A sound reproducing machine, including a double faced disk record tablet having sound grooves upon its opposite faces and means for simultaneously reproducing from the records upon the opposite sides of said disk.

In testimony whereof I have signed my name to this specification in the presence of 110 two subscribing witnesses.

## GUSTEN JUNGREN.

Witnesses:
Elsie M. Boesel, F. G. Bradbury.
T. A. EDISON.

PHONOGRAPH REPRODUCER.
APPLIOATION FILED MAR. 18, 1908.
996,625.
Patented July 4, 1911.


# UNITED STATES PATENT OFFICE 

## THOMAS A. EDISON, OF LLEWELLYN PARK, ORANGE, NEW JERSEY, ASSIGNOR TO NEW JERSEY PATENT COMPANY, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

PHONOGRAPH-REPRODUCER.
996,625.
Specification of Letters Patent. Patented July 4, 1911. Application filed March 18, 1908. Serial No. 421,888.

To all whom it may concern:
Be it known that I, Tifomas A. Edison, a citizen of the United States, and a resident of Llewellyn Park. Orange, comnty of Es-
5 sex, and State of New Jersey, have invented certain new and nseful Improvements in Phonograph-Reproducers, of which the following is a description.

Phonograph reproducers as now gener-
10 ally nsed, comprise a stylus having a curved surface adapted to be applied to the record groove with a suitable degree of pressure, and as the record surface travels said styhns slides along the surface of the groove and
15 moves toward and away from the body of the record.

My invention has for its object the elimination of the friction which is cansed by the sliding of the stylus over the record sur-
20 face by providing a stylus in the form of a roller or ball, and rotatably supporting the same, so that it presses mon ant rolls alomg the record surface.

My invention has for its further object 25 the provision of a support for the said stylus, which enables it to rotate with a minimum anoment of friction.
Referring to the accompanying drawing. Figure 1 is a side elevation of a phonograph
30 repodneer constructed in accordance with my invention; Fig. es is a detat section on line 2 2 of lig. 1 ; lig. 3 is a side cleval fion of as stylus lever carrying a morlified form of rotary stylus, and Fig. 1 is an cond 35 view of the sime.

The reprodncer shown comprises the somm box body 1, which carries a diaphatgun commeded to the styhes lever es ly the link :3, sald lewe being pivoted at +6
10 the floating weight th, which is pivotalle supported at fi, said parts beiner of well kmown form and entistrexton. If the emed of the
 roller 7 , which thrus on the ping 8 and is
45 provided wilh a growed pariphery, as shown in Fig. 2. Thar levere is reeresied to mective said moller 7 and provided with " pmir of downwardly cextending atus! , con-
nected by an integral web $1 t$, formed with an opening through which the lower part of the stylus 10 extends, in order to engige the record surface $a$, said stylus being supported by the walls of said opening so that it camot drop out of the opening when msupported ly the record simface. The stylus 10 is preferably of spherical form and may be of sapphire, metal or other suitable maiterial, the curvature of the styhus being the same as that of the peripherical groove of the roller 7. The stylus is loose with re- 60 spect to the lever 2 , so that when the stylus rests upon the record surface it is pressed into frictional ergagement with the periphery of the roller 7 , and the lather therefore forms a rotary abutment or support for the styhas, whereloy friction of the same against rotation is reduced to a minimmm. The floating weight a recoives its suppori from the record sinface throngh the stylus 10 . roller 7 and pin 8 . The lower surface of the weight 5 is recessed ass shown at 11. (1) permit a vertical movement of the roller 7 .

In the device of Figs. :3 and t, the stylus $10^{\prime}$ is in the form of a ball having tumnims: 12. The ends of which are retained be the fingers 1:3 formed in the conds of the aime: of the lever 2 , and said ball reats mpon the record surface "a and is pressed against the periphery of the roller 7 in the same manmer as the stylus of Figs. 1 and ㄹ. 'The rotary styhs and rotary ahoment maly il desimed. be suitahly momed for operatinge upon a wecod in ibe lom of a disk havinir a laterally mudulating record growe.
Dlaving now dess ribed me invention, what 1 chaim is:

1. In a phomoraph reproducer, the come bination of the Hating wright, Athes lew er

 the periphere of and rollore subatantinlly a sed lath.
 bination of the floating wright, stlan leme


strlus being held in engagement theremith br the pressure of the strlus upon the record surface. due to the floating meight, substantialls as set forth.
5 3. In a phonograph reproducer. the combination of the floating Teight. strlus lever piroted thereto. a groored roller carried br said lerer, and a rotatable curred strlus en-
gaging the periphery of said roller. substan-
tially as set forth.
This specification signed and witnessed this 13 thi dar of March 1905.

THOE. A. EDISON.
Titnesses:
Frant L. Dier,
Aris R. Klehis.

Copies of this patent may be obtained for are cents each, by addressing the "Commissioner of Patents, Washington, D. C. ${ }^{9}$

R. W. WEATHERMAN.<br>SOUND REPRODOCING INSTROMENT.<br>APPLIOATION FILED AUG. 19, 1910.<br>996,816.<br>Patented July 4, 1911.<br>3 SHEETS-SHEET 1.


R. W. WEATHERMAN.

SOUND REPRODOCING INSTROMENT.

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\text { APPLICATION FILED AUG. } 19,1910 .
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996,816.

Patented July 4, 1911.
3 SHEETS-SHEET 2.



# UNITED STATES PATENT OFFICE. 

ROBERT W. WEATHERMAN, OF SELMORE, MISSOURI, ASSIGNOR OF ONE-HALF TO FLOYD HARTLEY, OF SELMORE, MISSOURI.

SOUND-REPRODUCING INSTRUMENT.
$996,816$.
Specification of Letters Patent.
Patented July 4, 1911. Application filed August 19, 1910. Serial No. 578,016.

To all whom it may concern:
Be it known that I, Robert W. Weathermax, it citizen of the United States, residing at Selmore, in the county of Christian, State
5 of Missouri, have invented certain new and useful Improvements in Sound-Reproducing Instruments; and I do liereloy declare the following to be a full, clear, and exact description of the invention, such as will en-
10 able others skilled in the art to which it appertains to make and use the same.

This invention relates to sound reproducing instruments and has special reference to a mechanism used in connection with ma-
15 chines of the cylinder type to replace the styhus of the reproducer at the beginning of the record after the same has been played. The principal object of the invention is to improve and simplify the general con-
20 struction of devices of this character.
A second object of the invention is to provide a means of novel character for stopping the machine after the stylus has been moved back to the startimg point.
25 A third object of the invention is to provide a novel form of holder for the reproducer especially adapted to be used with an instrmment of this character.

With the above and other objects in view,
30 the invention consists in general of a sound reproducing instrmment of the class deseribed, provided with a novel and improved form of mechanism for moving the stylus hack to the starting point after a cylinder
35 has been played, said mechanism achating an improved reproducer arm.

The invention further consists in certain movel details of construction and combinations of parts horeinafter fully described,
40 illustrated in the accompanying drawings, and speceificalty sed fordt in the clams.

In the aceompanying drawings, like charnelers of reference indicate like parts in the several views, aml:- lignere is aplan
45 view of a phonograph fonstrineded and equipped in areordance with this invention. Fig. 2 is a rean clevalion thereof. Vín. 3 is "seetion on the line 3-3 of Fige. 1. Viog 4 is a sedtion on the line $1-1$ of riem. 1 .
,0 Fige to is a denail view of a certan throw off device used in commedion with this in-
 line fo-io of Five. 1.

The mumeral 10 indicates a portion of the
motor box or casing and this casing con- 5 tains an electric motor of suitable type, the same not being deemed necessary here to be shown as it forms no specific part of the invention. The casing is provided with the usual top 11 whereto is attached a base plate 12. Secured to the base plate adjacent one end is a pair of spaced standards 13 the space between the standards being closed in on the top and sides by a cover 14 . The spare thus inclosed forms the gear box for 65 the device. Journaled in the standards 13 is a shaft 15 on one end of which is a belt whee 1f over which rms the belt 17, this belt passing downward into the casing 10 and being driven by a snitable pulley on the motor in the nsual manner. The other end of the shaft 15 is provided with the usual mandrel 18 whereon may be held the cylindrical record 19. Secured to the base 12 is a bearing block 20 whereto is pisoted the lower end of an arm 21 provided with is centering projection 22 which engages in an opening in the end of the mandrel to hold the same in proper position while the machine is in operation. This arm 21 is held in cither the raised or bowered position by al snitable spring e 33 .

Fixed to ome of the stambards 13 amd extending out in parallel mation to the shaft. 15 is a roxl 21 . The mitere cond of this rod 85 21 is secomed to an arm 2.5 which projects firom a sandard 2 firmly fixed to the basie 12. Slitathe on the rome 21 is a sheeve 2 ? comprising a pair of spated sections whach
 ing tackward liom the adjacent emeds of the sed loms. Rextembing lowned from the embs of the yoke arms is in pair of spacel arms e! bedwen which is pivened the reprodnem
 S3 wherein is hed a mprothere 34 . Fixed to the bight of the rolie es is a some 35 Which passes themerth the rear amb of tha reproducer arm. It the rear of the vines :3:3 Here is pron ided an anomed serew ist which is timmly fived to the rimer. Held upon the
 a fork ind and 3s, the urms of the fork berine


 1 III 10 which serves (0) milust the pumition of the mprohture with refremme to the yok
and also to hold the rear end of the arm 37 . On the screm 36 is a thumb nut 41 which serves to hold the front end of the arm 37 in such manner that the projections 39 bear
5 firmly on the reproducer when the latter is in position. Extending from what may be termed the inner standard 13 to the standard 26 is a feed screw 42 of the ordinary type employed in machines of this character and ng feed screw is geared to the shaft 15 by beneath the shaft 42 is an arm 44 which is preferably integral with and projects downward and rearward from the yoke 28 . On rided a segmental nut 45 which is adapted to engage the screw 42 when the rear end of the arm is raised. The weight of the reproducer and parts forward of the rod 24 end of the arm 44 is to lift and hold the nut in position on the screw.
At 46 is a forked lug between the arms of which is piroted a lever 47. Between the 44 is a coil spring 48 . This arm 47 extends beneath a screw 49 of extremely coarse pitch which is geared to the last gear of the train 43 so that the two shafts 42 and 49 revolve
 of the arm 47 is a lug 50 which is arranged to be engaged by the coarse thread of the screw 49. In order to hold the lug out of engagement with said screw during the screw 42 the arm 47 has piroted thereto a latch 51, the upper end of which projects through an opening 52 formed in the rear end of the arm 44 and this latch is provided
the a noth 53 which is adapted to engage the edge of the opening 52 so that the rear ends of the arms 44 and 47 may be held apart against the action of the spring 48 .

Projecting rearwardly from the standard thumb screw 5.5 the extremity of which lies in the path of the upper end of the latch 51. This thumb screw has surrounding its stem between its head and the arm 54 a spring 56 which acts as a lock spring to prevent accidental movement of said screw. Now, in the operation of this portion of the device when the machine is started the reproducer will travel toward the left of Fig.
552 until the latch strikes the screw 55 . When the latch thus strikes said screw the notch will be released from its engagement with the arm 44 and the spring 48 will force the arm 47 upward at its rear end until the lug
6050 contacts with the screw 49. The arrangement of the parts is such that the spring 48 is of sufficient strength to contimue this movement by forcing the rear end of the arm 44 downward and thus releasing
cause the stylus of the reproducer to rise from the record and the screw 49 will move said reproducer rapidly toward the right.

In order to stop the machine when the reproducer has been returned to the starting point there is provided a switch 57 which controls the current to the motor. This switch is connected by a link 58 with a lever 59 piroted to a lug 60 mounted on the inner standard 13 . The other end of this lever lies in the path of an arm 61 which projects from the arm 47 , the lerer end lying in said path when said arm 47 is raised to engage the screw 49. The arrangement is such that as the reproducer is mored back to the starting point by the screw 49 the engagement of the arm 61 and lever 59 will open the switch 57 and thus throw the current off the motor so that the latter can stop. When it is desired to restart the instrument the arm 47 is depressed by means of the latch 51 and the latter engaged with the arm 44 as previously described. This will leave the end of the lever 59 free to be mored in such position that the switch will be closed and the motor started.

The operation of the different parts of the derice haring been described it is merely necessary to say that the crlinder is placed upon the mandrel in the ordinary way and the reproducer allowed to rest upon the cylinder by moring the latch to such position that the nut 45 engages with the screw 42. The switch is then closed and the machine started. Upon arriving at the end of its travel the latch will be disengaged, the reproducer returned to the starting point and the machine stopped.

There has thus been provided a simple and efficient derice of the kind described and 105 for the purpose specified.

Haring thus described the inrention, what is claimed as new, is:-

1. In a derice of the kind described, a guide rod, a sleere mounted on said guide 110 rod, a feed screw, means to actuate said feed screw, an arm projecting from said sleeve -transverse of said feed screw, a segmental nut carried by said arm and adapted to engage said feed screw, a second arm pivoted to the first mentioned arm, a lug adjacent one end of said second arm, a return screw geared to said feed screw and adapted to engage said lug, releasable latch means to hold the lug carrying end of the second arm away from the first arm, means to release said latch when the sleere has moved to a predetermined point on the rod, and means constantly urging the lug carrying end of the second arm toward the first arm.
2. In a device of the kind described, a guide rod, a sleeve mounted on said guide rod, a feed screm, a return screw, means to actuate said feed and return screws, an arm projecting from said sleeve and extending
beneath said feed screw, a segmental nut on the upper side of said arm adapted for engagement with the feed screw when the arm is raised, a second arm pivoted intermediate its ends beneath the first arm, said second arm haring one end projecting beneath the return screw, a lug on said second arm engageable with the return screw, a spring between said arms adapted to force said sec10 ond arm against said return screw and thereby depress the first arm, a releasable latch to hold said second arm away from said return screw, and means to release said latch when the sleeve has moved to a predetermined point on said rod.
3. In a device of the kind described, a guide rod, a sleeve mounted on said guide rod, a feed screw, a return screw, means to actuate said feed and return screws, an arm
20 projecting from said sleeve and exterding beneath saicl feed screw, a segmental nut on the upper side of said arm adapted for engagement with the feed screw when the arm is raised, a second arm pivoted intermedi-
25 ate its ends beneath the first arm, said second arm having one end projecting beneath the return screw, a lug on said second arm engageable with the return screw, a spring between said arms adapted to force said sec-
30 ond arm against said return screw and thereby depress the first arm, a latch pivoted to the second arm and having a notch engaging the first arm to hold said second arm from actuation by said spring, and means to re-
35 lease said latch when said sleeve has moved to a predetermined point on said rod.
4. In a device of the kind described, a guide rod, a sleeve mounted on satid guide rod, a feed screw, a return screw, means to actate said feed and return screws, an arm projecting from said sleeve and extending beneath said feed screw, a segmental nut on the upper side of said arm adapted for engagement with the feed screw when the arm ate its ends beneath the first arm, said second arm having one end projecting beneath the return screw, a hig on said second arm engageable with the return screw, a spring bewen said arms adapted to force said second arm against said return screw and thereby depress the first arm, a latel piroted to the second arm and having a notel engaging the first arm to hold said second arm from achation by said spring, a pair of spaced standards supporting said serews, and a thmub serew (antiod by one of said standards and lying in the path of said lateh when the latter is engaged with the first am.
5. In a device of the kind deseribed, a gnide rod, a sleeve mominted on said gnide rod, a feed screw, means to actmate said feed scow, an arm projeding foom said slewe transverse of satid feed serew, in segmental
gage said feed screw, a second arm piroted to the first mentioned arm, a lug adjacent one end of said second arm, a return screw geared to said feed screw and adapted to engage said lug, releasable latch means to hold the lug carrying end of the second arm away from the first arm, means to release said latch when the sleeve has moved to a predetcrmined point on the rod, and means constantly urging the lug carrying end of the second arm toward the first arm; in combination with a switch actuating mechanism lying in the path of the lug carrying arm when the latter is engaged with the return screw.
6. In a device of the kind described, a guide rod, a sleeve mounted on said guide rod, a feed screw, a return screw, means to actuate said feed and return screws, an arm projecting from said sleeve and extending beneath said feed screw, a segmental nut on the upper side of said arm adapted for engagement with the feed screw when the arm is raised, a second arm pivoted intermediate its ends beneath the first arm, said second arm having one end projecting beneath the return screw, a lug on said second arm engageable with the return screw, a spring between said arms adapted to force said second arm against said return screw and thereby depress the first arm, a releasable latch to hold said second arm away from said return screw, and means to release said latch when the sleeve has moved to a predetermined point on said rod; in combination with a switch actuating mechanism lying in the path of the lug carrying arm when the latter is engaged with the return screw.
7. In a device of the kind described, a guide rod, a sleeve mounted on said guide rod, a feed screw, a return screw, means to actuate sald feed and return screws, an arm projecting from said sleeve and extenting beneath said feed screw, a segmental nut on the upper side of said arm adapted for cugagement with the feed screw when the arm is raised, a secoud amp pivoted intermedinto its ends beneath the first arm, said second am having one end projecting bencath the return serew, a lug on said sedond arme engageable with the weturn screw, a spring between said amons adaped to foree sald seceond arm against salud rethen serew and thereby deperess the first am, a latch piroted to the second arm and having a noteh (mgaging the first arm to hold salid second atm from actuation by satid spring, and meatis to telemser sald lateh when suld sleeve has mowed to a predetermined point on satid rod: in combination with a swith :actuntingr mechanism lying in the path of the hag carving arm when the latter is cognged with the return sume.
8. In : device of the kind deseribed, a 130
guide rod, a sleeve mounted on said guide rod, a feed screw, a return screw, means to actuate said feed and return screws, an arm projecting from said sleere and extending beneath said feed screw, a segmental nut on the upper side of said arm adapted for engagement with the feed screw when the arm is raised, a second arm piroted intermediate its ends beneath the first arm, said second
10 arm having one end projecting beneath the return screw, a lug on said second arm engageable with the return screw, a spring between said arms adapted to force said second arm against said return screw and thereby depress the first arm, a latch pivoted to the second arm and having a notch
engaging the first arm to hold said second arm from actuation by said spring, a pair of spaced standards supporting said screws, and a thumb screw carried by one of said standards and lying in the path of said latch when the latter is engaged with the first arm, in combination with a switch actuating mechanism lying in the path of the lug carrying arm when the latter is engaged with the return screm.

In testimony whereof, I affix my signature, in presence of two witnesses.

ROBERT IT. WEATHERMAN.
Witnesses:
Floyd Hartley,
Т. Ј. Намis.

Cories of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
R. A. BOSWELL.

AMPLIFYING TUBE.
Patented July 11, 1911.
2 SHEETS-SHEET 1.


# R. A. BOSWELL. <br> AMPLIFYING TUBE, <br> APPLIOATION FILED SEPT. $26,1910$. 

997,265.
Patented July 11, 1911.
2 SHEETS-SHEET 2.


# UNITED STATES PATENT OFFICE． 

ROBERT A．BOSWELI，OF WASHINGTON，DISTRICT OF COLUMBIA．

## AMPLIFYING－TUBE．

997，265．
Specification of Letters Patent．Patented July 11， 1911. Application filed September 26，1910．Serial No．583，704．

## To all whom it may concern：

Be it known that Robert A．Bosivell，a citizen of the United States of America，re－ siding at Washington city，District of Co－
5 lumbia，has invented a new and useful Amplifying－Tube，of which the following is a specification．

This invention is classified in the art of acoustics，and it essentially pertains to a
10 new and useful amplifying tube or horn， adapted for use upon a talking machine of a type which is generally known as the cyl－ inder machine．

In machines of the cylinder type，prior to 15 this invention，the bell portion of the ma－ jority of the amplifying tubes is pivotally supported，while the smaller portion of the tube has a pivotal or swiveled connection with the reproducer in such wise as to allow
20 the amplifying tube or horn to oscillate，as the reprodicer is fed along the record．This structure of machine，it has been held，in some respects，is m－symmetrical，awkward and clumss，and，the basic purpose of this
25 invention is to eliminate these oljectionable features，and furtlommore，to improve the structural details of the amplifier．By im－ proving such structural details，the sound， to some extent，is inereased，becanse of the
30 lengthy travel（which has been increased be－ yond that heretofore ntilized）of the volume of sound throngh）the amplifier（the greater portion of whel is restrieted to a very small diameter in（ross section）．The rolume of
35 sommal．when passing throngh this restricted portion of the amplifier．is leck constricted matil it reaches a point，where the amplifier begins to enlarge into the bell portion there－ of．In climinating the oljectiomable fea－
40 （Heses an amplifier on tube is produced，which twaels laterally of the reeord，and，as one borly with the reprohnere and its arm；the amplifier beiner so shaperd，mounterd，wad supponted as to allow the mproduce to be raiserl，and，in so doing，the tome－arm is meverl tolescopisally and lomgitadinally with regand to the remainder of the ampli－ fier．This amplifier comprises an intermedi－ atre supported potion，known as the com－
 scopi＂ally and longitulinally mosmbo in w－
 member．White the wher is the tone wim．
 mone teleseapicolly，with relation lo Hice
compound curved member，but may be oscil－ lated laterally，because it is provided with a contracted curved portion，which is tele－ scopically movable with regard to a tubular member correspondingly curved．This tubu－ lar member，in other words，is an additional compound curved member，which is tele－ scopically morable with regard to the first－ named componud curved tubular＇member． In Fignre 6，howevar，the bell member is allowed to oscillate laterally，becanse it con－ sists of two parts，the bell member and the extension thereof，joined together by one， two or three threads；the extension being telescopically movable relatively to the com－ pomed cursed tubular nember，for instance， the first－mentioned compound curved mem－ ber．This same structure is shown also in Figure 5 in side eleration．The invention not only embraces the above fealures．but embodies means，wherely as the bell member is raised and lowered，the extension therenf moves exactly concentric in conjunction with the connpound comed member，and may be held in any desited position．When the re－ prodncer is lifted to the fullest extent abore the record，it may be readily smported，as shown in dotted lines．

The drawing only discloses one form of the invention，but in practical fields．this， form may necessitate changes and altera－ tions．to whech the applicant is entitled，pro－ vided such changes and alterations are com－ prehended by the appended daims．

Referming to the drawings，
Figme 1 is a side eleration of a talking machine gencerally known is the colinder machine provided with what is known in
 member，for the suppert of the free moving parts of the amplifice．





ligure ：3 is a detail sertional than homi melinally f1ronglo the stretare shown in ドiツッいこ。
Figmon is a top plan tion of the ampli






first-named compound curved tubular member and the curved contracted end of the bell member.
Figure 5 is a side elevation of the first5 named compound curved tubular member, a portion of the tone arm, a portion of the bell member and its extension, showing the threaded connection between the extension and the bell member, and clearly disclosing 0 the fact that these parts are telescopically morable with regard to one another, and further showing the means whereby the extension and the bell member may more exactly concentric with regard to the com-
pound curved member.
Figure 6 is a top plan view of the structure shown in Figure 5.
Figure 7 is a detail eleration of the joint or connection between the extension or the 20 second-named compound curved tubular member and the first-named compound curred tubular member.
Figure 8 is a side elevation of the same form of machine as shown in Figure 1, only illustrating the fact that the bell member has a curred contracted end portion and fulcrumed upon the reproducer arm, and showing that the curved contracted portion is telescopically movable with regard to the tone 30 arm.

Figure 9 is a sectional riew on line $9-9$ of Figure ă.
As to the drawings, 1 denotes the casing of the talking machine, containing the usual mechanism. (not shown), for rotating the record and the mandrel ; the structure of the mandrel forms no part of the present invention.
In mounting an amplifier upon this style
40 of machine, the same necessarily has to be moved laterally, and as one body, with the reproducer and its arm. This lateral movement is acomplished by disposing of the usual form of guide rod (which is usually cylindrical) and in its place the rod 2 is arranged. This rod 2 is rectangular in cross section. and receives the sleeve 3 . This sleeve 3 is slidable laterally upon the rod 2, for the reason that it is provided with a recangular bore 4 . The ends of the rod 2 may be supported in bearings of the frame of the machine in any conventional manner. as shown at 5 . It is to be minderstood that in practice the ends of this rod must be remored, for instance. the ends of this rod may only have sufficient frictional bearings in the frame of the machine, of such a character as to allow the same to be readily
60 moved by forcing a sliding action therets. The ontside circumference of the sleeve 3 is crlindrical in order to provide a pivotal bearing for the reproducer arm 6 , and is provided at one end with threads 7 . to receive
ment, laterally, of the reproducer arm. It will be readily understood that the reproducer arm may be easily raised and lowered upon the sleeve. At one end of the slecre, an arm 9 rearwardly projects, and where this arm forms a part of the sleere, a shoulder 10 is provided, a gainst which the reproducer arm 6 abuts. Between this shoulder and the nut, the reproducer arm 6 is positioned. The rearwardly projecting arm 9 extends rearwardly sufficient to allow the reproducer arm to swing or oscillate upon an arc of a circle, using the rod 2 as a center. The rearwardly extending arm 9 connects with the compound curved tubular member 11. This connection between the arm 9 and the member 11 may be integral, as shown in Figure 1, or detachable, as shomn in Figure 5 . If made detachable, the arm 9 and the arm 12 are made in one piece, and where they project from the compound curred tubular member, they are recessed to receive the said member 11 , and are clamped to the member 11 by the plate 13.

The reproducer arm 6 carries the usual form of reproducer 14, to which is connected the tone arm 15 . by means of the threaded connection 16. This tone arm 15 is correspondingly curved with regard to the compound curved tubular member 11, in order that when the reproducer and its arm 6 is lifted or raised from the record, the tone arm will telescopically more relatively to the curved member 11 . When the reproducer and its arm is raised or lifted, the same is supported in such position by the slight curve 17 of the tone arme coming in contact with the upper forward end 18 of the member 11, as shown in dotted lines in Figure 1. 19 represents the bell member of the amplifier having a contracted end portion 20. which terminates ints a curved portion or neck 21. 22 denotes an additional compound curred tubular member, the portion 23 of which is correspondingly curved with relation to the curved portion or neck 21. and is designed to telescopically receire said portion or neck 21, while the portion 24 of the additional compound curved tubular member is curred correspondingly with regard to the first-named compound curved tubular member and is received thereby. The compound curved tubnlar member 11 in Figure 1 is formed with an arm 2.) (which is similar to the arm 12 in Figure 5). it being possible to mount the arm 25 in the same manner as the arms 9 and 12 are mounted on the said member 11. This arm 25 extends to a point, marked $2 \bar{J}^{\text {a }}$ on which the are of a portion of the member 11, and the portion $2 t$ of the member 22 are curved. The extremities of the arms 2.5 and 12 are bifurcated, as shown clearly in Figures 4. 6 and 7. in order to receive the extremity of the arm 26, or it may be plain, as shomi in Figures 1
and 5 , and the extremities of the arms 25 and 12 and the arm 26 clamped together by means of a bolt and winged nut 27 and 28 . When the arms 2.5 and 12 having the bifur-
5 cated portion receive the extremity of the arme 26 , they are clamped in position by the aid of the bolt 29 and the winged nut 30 as shown clearly in Figures 4, 6 and 7 , thereby holding the bell member, and the additional
10 compound curved tubular member in various positions. By the production of these coüperating arms 25: or 12 and the arm 26, the bell member and the extension therenf or the additional componnd curved member 22 may be moved or oscillated exactly concentric with regard to their centers. The arn 26 may be detachably connected with the portion $2 t$, in the same manner as the arms 9 and 12 are connected in Figure 5.
Attention is directed to the structure shown in Figure 5, in which the bell member 19 has its contracted portion 20 terminating in a downwardly curved portion or neck 31. This downwardly curved portion 31 has of the bell member, as at 33, whereby the bell member may be allowed to oscillate laterally of the machine. This extension 32 is curved correspondingly with regard to the member and is telesopically recerved therebs, so that the bell menter may be raised or lowered. When the bell member 19) is raised or lowered, the same may be held in various positions by tightening up the winged mit ar the winged nut 28 in Figure a. It will be evident, upon referring to Figure 5, that the arm 26 may be commecter to the extension at any suitable location, in practice. in onder that the throw of the bell member may be increased or decreased.
It will be olserved that when it is desiom 10 adjust the bell member 19 in Figure 1, the curved neck 21 coüperates with the portion 23 of the additional compenud anved mem-
 23) in practice may be changed somewhat in shape to vary the lateral osceilation of the bell members: The bell momber is limited in its osseillation by the contraded pontion 20 coming in eombet with the extremity of the curvel portion 2\%, When mosing in one direedion, and when in the othere direrdion, Ha contracted portion 20 comtats al the peoint






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which equally balances with the rearwardly extending portions of the amplifier or the telescopically connected sections. In this mamer, the equilibrium of the machine is readily maintained.

In Figure $S$ the tone arm 15 is connected to the reproducer 14 in the same manner as shown in Figure 1, for instance by a threaded connection, and designated by the same character 16 . The bell member 19 terminates into a curved portion or neck 36 , which is correspondingly curved with regard to the tone arm 15 , and is received thereby. The bell member is provided with an arm 37 , which may be integral or detachably connected therewith. The reproducer arm 6 in Figure $S$ is formed with an arm 38. This arm 38 is provided with the bifurcated end similar to the arms 2.5 and $1 \%$. as shown clearly in Figure $T_{\text {, and }}$ in the bifurcated portion of this arm $3 S$ the extremity of the arm 37 is disposed. The bifurcated end of the arm 38 and the extremity of the arm 37 have a bolt 39 penetrating them, and to the threaded end of the bolt, the winged mot 40 is applied. The bolt 39 is similar to the bolt 29 in Finure 7. As the bell member 19 is raised or lowered, the chrved portion or neck 36 mores telescopically with regard to the tone arm 15, and cxactly concentric therewith, because of the connections between the arms 37 and 38 . It may be clearly noted how the ranions structures in the drawings are operated. It will be further observed that this form of amplifier embodies rarions nowel features. which have heretofore not been concerived. and in so constructing an amplifier of this desion. for application upon a matchine ol this type the same moves laterally with regatd to the madhine and the record. It is morlerstood that no matter where the amplifier is positioned as it is movine laterally of the reeored. the bell member maty be oreillated later:lly.

The cirved portion or neek 21 mat the (romed portion se are provided with pivoted cö̈porating arms to and tis smilar fo tho
 by a bolt and a wingerl mit 11 and (o).

In weder (or assemble lhe portions el and
 amd 15. ther pand theine lime insemed in the portion 2:?, after which the part lit is
 joint and then secomely suldered wo wher "ior lastoned or mate permanoul. This is anly onf mathod wf asismbling the portions: $\because 1$ :mal $\because: 3$, it bomin evident that wher methonf ma! le emploded.
'The invention having loren set ford w, what is relamed as mew amd nedfal is:

 tumber; atad talacopically mosable fros
portions correspondingly curved and supported from either end of the member.
2. A laterally movable amplifier; comprising a compound curved tubular mem§ ber; telescopically morable free portions correspondingly curved and supported from either end of the member; and means permitting one of the free portions to move concentrically with regard to the member. comprising a compound curved tubular member; telescopically movable free portions correspondingly curved and supported from either end of the member; and means either of the free portions in rarious positions.
4. A laterally movable amplifier; comprising a compound curved tubular member; spondingly curved and supported from either end of the member; means permitting one of the free portions to more concentrically with regard to the member; the means tions in rarious positions.
5. In an amplifier; a compound curved tubular member; and a free end portion
means with the member, whereby the free end portion may have universal movements.
6. In an amplifier; a compound curred tubular member; and a free end portion having telescopic connecting means with the member, whereby the free end portion may have universal morements; and means permitting the free end portion to move concentrically with regard to the member.
7 . In an amplifier; a compound curyed tubular member; a free end portion having telescopically morable connections with the member. whereby the free portion may oscillate laterally and rertically; means permitting the free end portion to move concentrically with regard to the member; the means including means for holding the free end portion in adjusted positions when moved.
ingly curved with regard to the additional compound corved member and telescopically comected to it : sald additional compound curved member constituting a medinm to permit the free end portion to oscillate laterally and vertically.
3. In an amplifier; a componnd curved tubnlar member; an additional compound curved tubular member telescopically mited with the first tubular member; a free end portion having an extension correspond-
ingly curved with regard to the additional compound curved member and telescopically connected to it; said additional compound curved member constituting a medium to permit the free end portion to oscillate laterally and vertically; and means permitting the free end portion and the additional compound curved member to move concentrically with regard to one another.
10. In an amplifier; a compound curved 75 tubular member; an additional compound curved tubular member telescopically united to the first tubular member; a free end portion haring an extension correspondingly curved with regard to the additional compound curved member and telescopically united to it ; the additional compound curved member constituting a medium to permit the free end portion to oscillate universally; means permitting the free end portion, when oscillated in one direction, to move concentrically with regard to one member and, when oscillated in the other direction, to move concentrically with regard to the other member; the means including means to hold either the additional compound curved member or the free portion in adjusted positions.
11. In an amplifier; a compound curved tubular member; a free portion having connections with the member; the comnections embodying correspondingly curved telescopically movable united parts to permit the free portion to more universally through the medium of the parts; the comnections including means whereby the free portion may move concentrically with regard to the member.
12. In an amplifier; a compound curved tubular member; a free portion having connections with the member; the connections embodying correspondingly curved telescopically morable united parts to permit the free portion to move universally through the medium of the parts; the connections including means whereby the free portion may move concentrically with regard to the member: the means for permitting the free portion to move concentrically embodying means to hold the free portion in rarious adjusted positions.
13. In an amplifier; a compound curred tubular member; an additional compound curved tubular member telescopically united with the first tubular member'; a free end portion haring an extension correspondingly curved in regard to the additional compound curved member and telescopically united to it; the additional compound curved member constituting a medium to permit the free end portion to oscillate universally; means permitting the free end portion and the additional compound curved member to more concentrically with regard to one another; and means permitting the
additional compound curved member to move concentrically with regard to the first compound curved member.
14. A laterally movable amplifying horn 5 comprising a compound curved tubular member ; movable free portions, correspondingly curved and telescopically connected to the member to have longitudinal telescopical movements therewith, one of the free por-
10 tions embodying such connections with the member as to permit the same to oscillate universally; means permitting one of the
free portions to more concentrically with regard to the member, and including means to hold one of the free portions in its ad- 15 justed positions.

In witness whereof, the applicant’s signature, is hereunto affixed in the presence of two witnesses.

ROBERT A. BOSWELL.
Witnesses:
Herbert D. Latwson,
William Crichton Clarke.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
G. L. STEVENSON.

HORN,
APPLICATION FILED APR, $15,1910$.
997,870.
Patented July 11, 1911.


Fig. 1.


Fig. 2.


Fig. 5.


WITNESSES
E.O. Cg den

Frederic of. Creme

GoorgeL.SLévenson.
Howard Gevarlow.

# UNITED STATES PATENT OFFICE. 

GEORGE L. STEVENSON, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO HOUSEHOLD CABINET WORKS, OF FROVIDENCE, RHODE ISLAND, A CORPORATION OF RHODE ISLAND.<br>HORN.

$99 \%, 8^{\prime 2} \%$.
-
Specification of Letters Patent. Patented July 11, 19)11. Application filed April 15, 1910. Serial No. 555,608.

## To all whom it may concern:

Be it known that I, George L. Sterevson, a citizen of the United States, residing at the city of Providence, in the county of
5 Providence and State of Rhode Island, have invented certain new and useful Improvements in Horns, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to a sound amplifying device, commonly known as a horn, the same being more particularly adapted for use on sound reproducing instruments such as phonographs or the like.
15 The object of the invention is to construct a horn having unusual acoustic properties wherely the sound is not only amplified but where the phonetic principles of clear, articulate, yet soft and mellow sound are produced, in contrary distinction to the effect of the ordinary flaring or bell-mouthed horn which merely enlarges the sound without refining it.

A further object of the invention is to simple and inexpensive in construction takes u!) but comparatively litfle room when used either inside or outside of a phonograph supporting cabinet, or upon being stored a way when not in use.
With these and other objects in view, the invention consists of certain novel features of constrinction, as will be more fully deseribed and particularly pointed out in the appended claims.

In the accompanying drawings: Figure 1- shows my improved hom as mounted on the inside of a cabinet or box on which the phonograph is supported. Fig. 2- illustrates the horn as applied to the ordinary incepensive phonograph instrmment. Fig. 3- is an colarged perspective riew of my improved hom showing the walls of the same thrmed inward at its mont end forming a contracted upening instemd of being tumed ont ward as is the misalal chstom. Fig. 1 - is a central longitudinal section thromgh this hom. Figr. 5 - is a tramserse sectional view of the horn on lime ! - 5 of Fig. I.

In carrying out my invention! I have provided an improsed hom which is preforably constructed with a contracted neck portion 1 adapted to be comeeted ly a tule 2, of other snitable menns to the needle earying or somed trmismitting nrm 3. 'This nerk por-
tion is then gradually enlarged into the body portion substantially rectangular in cross section, whese top and bottom plates a and 6 are broad and substantially flat and whose sides 7 and 8 are comparatively nar- 60 row and set substantially at right angles to saicd top and bottom sections, said top, bottom and sides forming, in effect. sounding boards. The sides of the body after diverging or rounding outward for about threequarters of the length of the body then converge or turn inward as at 9 and 10 toward the open end forming a contracted mouth or opening 11 through which the sound is cmittcel. The top and bottom sections a and (f after spreading apart slightly from the neck portion 1 may also converge or draw mather abruptly inward as at 12 and 13 making a still finther contraction to the mouth 11. This last contraction, however, is not absolutely essential as these plates may be straight completely to the mouth if desired. This hom may be made of any desired or suitable material but I preferably construct the same like a violin body of thin boards or plates of wood, and join the sections together by glue or by other suitable means. It is fomd in pactice, outside of the aconslie promerties of this style of horn, that it is very inexpensite in construction as compared with the flaring bell-shaped horn, also that it takes up rery much less romm than the old style horn and can be packed or Hored away in mand less space. This horn is particularly adapted to be nsed within a cabined or box $1+$ and connected to the masi(al instrmuent 15 by a tube, if desired, as illustrated in Fig. 1, on it may be conneded on the matside and abowe the instrament itwolf, as illustrated in Fig. 2, or in ally wher sultable or consenient way.
My improved construction or form of horn, hass ant cularged thin dat fubmbar somnd mmplifying borly sulstuntially rectangular in cross sedion, ns illustrated in 100 Fige 3, in which there is 11 small needs porfion throngh which the somad enters and a somewhat contracted mouth or opening at the "pposite emd through which the somul is cmittod, thas being in form and affer similar to the human throat, month convity und opsoning thomgh the lips hewerin the teeth, the comberging pertions: ? 10, 12 athl li3 loing similan in chted to the remf of the mombl, gimes and leeth forming 180
the sounding-board for reverberating, amplifying and mellowing the sound waves while passing through the horn.

The shape of the horn as best shown in 5 Fig. 3 provides wide upper and lower plates 5 and 6 which, especially when made of thin wood, enable a resonance to be obtained which can be compared with that of a violin. This resonance cannot be obtained from a plurality of narrow strips. Therefore the said shape of the horn not only mellows the sound waves in the manner hereinbefore mentioned as comparable with the mellowing effect produced upon the human voice by the shape of the mouth, but also attains the amplifying and resonant effect obtained from broad, thin, single sheets of wood.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A horn having relatively wide and flat
upper and lower plates forming sounding boards, and relatively narrow sides connecting said plates and also serving as 25 sounding boards, said plates and sides diverging from the inlet end of said horn, the outlet ends of said sides being turned inwardly to form a contracted mouth.
2. A horn having relatively wide and flat 30 upper and lower plates forming sounding boards, and relatively narrow sides connecting said plates and also serving as sounding boards, said plates and sides diverging from the inlet end of said horn, the 35 outlet ends of said sides and said top and bottom plates being turned inwardly to form a contracted mouth.
In testimony whereof I affix my signature in presence of two witnesses.

GEORGE L. STEVENSON.
Witnesses:
Walter H. Barney,
Edifin B. Lincoln.

C. A. COOPER.

PHONOGRAPH CABINET.
application filed apr. 16, 1910.
997,905.
Patented July 11, 1911.
2 SHEETS-SHEET 1.
Fig. 1.


Fig. 2.
Fig. 3.


997,905.

Patented July 11, 1911. 2 sheets-sheet 2.


Fig. 5.

Slerbat \&. Kidley
E. S. Cegden
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## UNITED STATES PATENT OFFICE.

CHARLES A. COOPER, OF NEW YORK, N. Y., ASSIGNOR TO HOUSEHOLD CABINET WORKS, OF PROVIDENCE, RHODE ISLAND, A CORPORATION OF RHODE ISLAND.

PHONOGRAPH-CABINET.
997,905.
Specification of Letters Patent. Patented July 11, 1911. Application filed April 15, 1910. Serial No. 555,623.

## To all whom it may concern:

Be it known that I, Charles A. Cooper, a citizen of the United States, residing at the city of New York, in the county of New
5 York, and State of New York, have invented certain new and useful Improvements in Phonograph-Cabinets, of which the following is a specification, reference being had therein to the accompanying 10 drawing.

The object of this invention is to provide a drop-head table or cabinet, in which a panel, head, or movable section is arranged to support a sound reproducing instrument,
15 such as a phonograph or the like, said instrument being provided with a horn or suitable device for enlarging, intensifying and diffusing the sound produced by saicl instrument, said horn being mounted be-年 ranged to be raised and lowered with the instrument and said movable panel.

A further object of the invention is to provide an opening through the outer wall me cabinet adapted to register with -hi month of the hom when raised to its operative position, to permit the sound to pass out therethrough, said opening being provided with a plurality of longitudinal bars or 0 members to aid and assist the aconst ic properties of the loorn.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully de5 scribed and particularly pointed out in the appended claim.

In the aceompanying drawings: Figure 1 - is a perspective view illustrating a cabinct having a drop head or movable 40 section, the satme being in its raised position and the operating leaf in its extended position. Fig. 2-is an cmlarged sectional view on line 2-2 of lifg. 1 thronght the hoisting mechanism, ilhsitrating the mov- is a plan view of the (foop head showing the relative position of the pertical gnides and the members by which the head is smpported. Fiig. 4- is a central sectional side
elevation of the cabinet showing the instru- 50 ment in position on the drop head and the horn supported from said instrument within the cabinct, the whole being in its raised or operative position. Fig. 5- is the same as Fig. 4 showing the cabinet as closed and the instrument and horn lowered into the cabinet to its inoperative position. Fig. 6 - is a detail of one style of horn which may be supported within the cabinet to be raised and lowered with the phonograph 60 and the drop head.

Referring to the drawings 1 designates the cabinet which is designed more particularly for the support and reception of a phenograph 2 or other somed reproducing
 the drop head or movable section 3 thereof. The horm 4 or somed elaborating device is designed to be supported by any suitable means below the drop head and within the 70 cabinet chamber a, so that said horn will move up and down with each movement of said head. This horn may be of any desired or convenient shape and is preferably mounted in a horizontal position, its rear end being provided with a contracted neek portion 6 into which fits the lower end it of the tube 8 , this thbe then extemds nipward therefrom throngh the opening $s^{\prime}$ in the drop head, the upper end of sath bute being comnected at ? to the minal sommed tramsmitting arme 10. When the hom and drop head are in their raised on operating position the month 11 of the horn is bromght into a position to register with the openinges 55 12 in the fromt wall of the embinet. Thin bars 13 of wood or other suitable materinal. preferably tapering in arose section from the ontside inward, are placed at close intervals lomgitudinally acrosis this openinger bimarily for the pmincos of adinge in obtaining a more eftect tive distribution of thesombl cmitted thromery the herm. 'These har-ahor seree as an ormanemt in the design of the


The top pertion ts of the tahle one aho
 swinging or extending leaf or member lis
hinged at 17 and when in its extended position it lies against and is supported on the ledge 18. This top portion is provided with an aperture 19 into which is

$$
5
$$ drop head or movable section 3. Cords 20, 21,22 and 23 are preferably connected to the four corners of this morable section. the cords 22 and 23 being brought together led out over pulley 26 and secured at 27 to the extension leaf, see Fig. 1, while the cords 20 and 21 on the opposite side of the morable section are brought together in a part 28 over pulley 29 and is fastened at 30 to the opposite edge of the extension leaf 16. Suitable guide bars 31 are arranged to extend from the table top down to an inclosing ends of the cuide arms 33. I do not restrict myself to this particular arrangement for operating this drop head as any desirable or suitable means may be employed for this

${ }^{25}$ purpose.
The space above the partition 32 forms a convenient inclosing receptacle into which the drop head with its horn and its supported machine may be lowered, said head adapted to rest upon the four upright supporting posts 34 , which receive the weight and prevent the horn from coming into contact with said partition.

The lower portion of this cabinet may be provided with shelves or otherwise arranged for the reception of the collection of record disks used in connection with the phonograph.

In the operation of my improved phonograph cabinet the leaf 15 is swung back to its extended position, as shown in Fig. 1. The phonograph is set upon the drop head, the horn 4 is passed through the removable section 35 in the back of the cabinet and 5 connected to the machine by means of the tube 8, which may serve, if desired, as the only supporting means for said horn. By this arrangement the horn is entirely concealed and the tone is rendered soft and 0 mellow by being conducted down through the cabinet 5 and out through the barred opening in the wall thereof. By this means the large, ulwieldy and in some cases unsightly horn, ordinarily employed with this class of phonograph is entirely eliminated, cnabling the machine and all of its attachments to be inclosed within the cabinet when desired.

When the phonograph is no longer re0 quired for immediate use it is only necessary to raise the free end of the leaf 3 and fold it over the top of the cabinet, whereby the drop head with its supported machine and horn will at once descend bodily into the compartment below, the aperture left
by the retreating head being covered by the leaf. leaving the face of the table plain and clear for other purposes. The machine and its attachments thus disposed of are entirely inclosed, are out of the way and protected from dirt and clust.

When it is again desired to operate the machine it is only necessary to raise the leaf, swing it outward on its hinges, thereby bringing the machine up level with the surface of the table and the mouth of the horn in position to register with the opening in the cabinet wall, it being then only necessary to position the records and the machine is ready for operation.

As shown by comparing Figs. 4 and 5, the phonograph and its amplifying horn are not changed as to their relationship whether raised or lomered or during raising or lowering. Therefore the instrument could be started playing while in the position shown in Fig. 4 and then lowered to the position shown in Fig. 5 while still continuing to play. When in the latter position, the volume of sound of course would be materially reduced so far as the sound can be emitted from the receptacle portion of the cabinet. In brief no adjustment whatever has to be made of any of the parts or the relationship of some parts to others whether the instrument is to be brought out to play with full rolume of sound, or is to be retired into the receptacle.

It will be observed that the drop head or instrument supporting section 3, when in raised position as shown in Fig. 4, substantially closes the opening in the top of the cabinet, thus confining the sound issuing from the horn to the space within the cabinet so that the sound issuing from the cabinet must come through the portion 12 where the acoustic properties of the horn can be softened or controlled. While in this operative position the disk or records of the instrument may be changed without shifting drop head 3 , and when desired the entire apparatus can be lowered entirely into the cabinet either while playing or when silent. The horn being under the section 3, and the latter closing the opening in the cabinet, result in the sound being exceedingly mellow, while still permitting the records of the instrument to be changed.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

The combination with a cabinet having an opening in its top, and a drop head adapted to close said opening, of a sound reproducing instrument supported on said drop head, a horn connected with said instrument and located below said drop head, said cabinet having a sound outlet opening with which the outlet of said horn coincides when said drop liead is raised, means in said last men-

tioned opening for diffusing the sound emitted from said horn, whereby the full volume of the sound is emitted when said drop head is in raised position, and means
5 for operating said drop head, whereby the said horn may be lowered below the plane of said sound outlet opening to direct the sound emitted from said horn against the
wall of said cabinet to deflect the same be-
fore it reaches said outlet opening.
In testimony whereof I affix my signature in presence of two witnesses.

CHARLES A. COOPER.
Witnesses:
Garrett D. Cooper,
H. I. Chatfield.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
W. A. CHAPMAN.

SOUND REPRODDCER AND RECORDER.
APPLIOATION FILED AUG. $11,1908$.
998,465.
Patented July 18, 1911.
3 SHEETS-SHEET 1.

W. A. CHAPMAN.

SOUND REPRODUCER AND RECORDER,
APPLIOATION FILED AUG. 11, 1908.
Patented July 18, 1911. 3 sheets-sheet 2.

W. A. CHAPMAN.

SOUND BEPRODUCER AND RECORDER,
APPIIOATION FILED AUG. 11, 1908

998,465.


Patented July 18, 1911. 3 SHEETS-SHEET 3.



WITNESSES Qren. Ioffés pomin. Bracurgo

# UNITED STATES PATENT OFFICE. <br> WILLIAM ALBERT CHAPIMAN, OF SMITHVILLE, ARKANSAS. <br> SOUND REPRODUCER AND RECORDER. 

$998,465$.
Specification of Letters Patent. Patented July 18, 1911. Application filed August 11, 1908. Serial No. 447,944.

## To all whom it may concern:

Be it known that I, Willeay Albert Chapman, a citizen of the United States, and a resident of Smithville, in the county of
5 Lawrence and State of Arkansas, have invented a new and Improved Sound Reproducer and Recorder, of which the following is a full, clear, and exact description.
This invention relates to sound recorders
10 and reproducers, and is particularly useful in connection with talking machines employing disk or other types of records upon which the sound waves are recorded in the form of grooves, and in which diaphragms
15 are used to reproduce the sounds from the grooves, or to form the grooves upon blank records.
An object of the invention is to provide a simple, inexpensive and durable sound re-
20 corder and reproducer, which is adapted for the dual purpose of forming the sound recording grooves in the record, and for reproducing the sounds from grooves already mpressed or formed upon the records, and
25 which requires no structural or other change to fit it for either purpose, beyond replacing a reeording needle or point by a reproducing needle or point or vice versa as the case may be.
30 A further object of the invention is to provide a device of the class described by means of which sounds can be reproduced with great clearness and power, and by means of which metallie, scratehing or other
35 midesitable somads due to the contact of the record with the reproducing point are to a large extent eliminaterd.
A still further oljoed of the invention is (0) provide a deviere of the class clescribed in 40 which the weight of the reproducer is sinpporded mot mon the recording ar emonheing point on needle, but is rarried ly a Sperial rotler prowided therefor athl enginging the reemol for this phepose, in which the
45 diaphagen is of specetal form and is free not only (o) viluate lout to mowe bodily, and in which the stylus ban is extensible and is:
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Amother oljoed of the insemtion is 10 prar vide: a sommed repmodnem in whida the stylus
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ments which cause the propagation of the sound wares, in which special means are provided for holding the recording or reproducing needles in place, and for adjusting them accurately so that the length of the stylus bar remains umchanged, and in which the stylus bar itself is flexibly suspended from a cradle secured to the sound box casing, though rigidly held against upward, 85 lateral and torsional morements.

The invention consists in the construction and combination of parts to be more fully described hereinafter and particularly set forth in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views, and in which-

Figure 1 is a front eleration of one embodiment of my sound recorder and reproducer; Fig. 2 is an inverted plan view of the device; Fig. 3 is a longitudinal section on the line 3-3 of Fig. 1: Fig. 4 is a partial rear elevation of the somad box: Fig. It is a rear eleration of the lower portion of the device; Figg. © is a rear or inside elevation of the diaphragh and the means for semering it in place; Fig. $\bar{i}$ is an mlarged transverse section showing a bracket for serming a record cleaning brush or scraper to the somed box; Fig. s is an enlarged fransionse section showing the needle grip): Fig.! is a perspective view showing a detail of the scraper-holding bracket: Fig. 10 is a perspective veew showing a dedail of the needle point grip; Fig. 11 is an conlarged transeme section showing the means of moditiod form for sechring the stylus ban fo the -ommed bex: and Fig. 12 is a longitmdinal eedion on the line 12 12 of lige. 11.
 planation of my imantion, it hombla be alearly mandersomed Hall while the ramm is particularly liserne in! combediou with talh-




 recorling perint and to inam in plate of is : mpontheng poin! or wedle. The memal ing print is mantially: : forminge the mathlating sombly gromes in tho wis of the master memel, wherema the

fashioned needle or point which merely follows the form of the grooves in the record and transmits its consequent ribrations to the diaphragm, which reproduces the sounds.
The degree of perfection attainable in the reproduction of sound waves as these are perpetuated upon a record depends to a large extent, upon the uniformity in width, pitch and smoothness of cut of the groores formed ord by the sound-impelled recording tool or graver. I find, furthermore, that the morement of the stylus bar in a talking machine, if the bar is mounted upon pirotal points or
15 ball or knife-edged bearings and is held thereon resiliently, speedily effects a new centering of the contacting points, owing to the wearing of these points on their seats and the weakening of the springs, together
20 with the lateral and upward pressure due to the weight of the sound box carried by the point in engagement with the record. The supporting of the weight upon the reproducing point, moreover, is productive of irregu-
25 lar and ungoverned movements of the cutting tool when the device is used as a recorcter, while in the reproducer it results in the production of chattering, scraping, and metallic sounds. In other forms of talking
30 machines in which the stylus bar is secured to the casing through the movement of a plate spring placed horizontally and transversely with respect to the plane of the diaphragm, I find that the lateral pressure in-
35 duces a torsional strain in the spring, materially reducing its resiliency and tending to enlarge the opening in the diaphragm at which the stylus bar is secured, whereby the diaphragm is weakened and its attachment 40 to the stylus bar is erentually loosened. In these rarious forms of mounting the stylus bar in place, the circular or arc movements of the ends of the stylus bar are intensified and result in an unequal bearing of the
45 diaphragm upon its seat; consequently, where the comnection between the stylus bar and the diaphragm is rigid, as when they are secured together by means of a screw and a plate, the are or circular morements effect
50 a shifting of the diaphragm on its seat, and unless such movement is provider for, a binding or buckling of the diaphragm results. with the development of lines of flection across its face.
55 Nica has long been considered among the most satisfactory of materials for talking machine diaphragms, but I find that with nse such diaphragms develop certain lines of weakness that very materially modify the
60 someds reprotheed. Firthermore, diaphragms as they are ordinarily mounted are tmed or keyed to certain predetermined ranges of notes within the limits of which the reproduction is good, but that when such
65 limits are exceeded there is an absence of
color tones, which renders the reproduction more or less harsh and unpleasant to the ear. In my device I provide a diaphragm which is attuned to a wide range of tones, by being so mounted that it is sensitive not only to vibrations of the usual kind, but to impulses which will produce bodily movements of the diaphragm in its entirety. The strlus bar which I have invented, is so formed that it transmits the impulses to the diaphragm at right angles to the plane of the same. The diaphragm is cushioned and its bodily movements are thus resiliently resisted. It is furthermore, insensitive to foreign and undesirable impulses transmitted, for example, through the sound box casing and consisting for instance, in the scraping sounds due to the contact of the needle point with the record.

I provide means for securing the needles or reproducing points to the stylus bar at a uniform length, so that the leverage is always the same. Furthormore, the stylus bar of my invention is extensible and thus permits the adjustment of the leverage when such adjustment is necessary or desirable.

I mount the stylus bar of my invention in such a manner that it is self-adjusting, cushioned, and highly responsive to slight impulses. There is no metallic contact between the stylus bar and the sound box casing or between the cradle which supports the stylus bar, and the casing. It mould seem that to secure constant and uniform motion in the stylus bar and to effect elimination of the metallic sounds, all loose, morable contact of the parts must be aroided. Again, the scratching, scraping somnd of the needle in its passage over the sound grooves, while it cannot be eliminated, must be separated from the sounds to be reproduced, and must be prevented from entering the sound tube, if the sound issuing therefrom is to be improved.

It is of great importance that the morement of the cutting tool when recording. and of the reproducing point, be hampered or hindered in no way whatsoever, and therefore, I have found it of adrantage to support the weight of the sound box upon a roller which engages the record, and which thus relieves the recording or reproducing point of this unnecessary weight. The roller is adjustable so that the sound box can be raised or lowered as necessary, with respect to the record.

I have found that the rolume of sound can be modified without the use of a special needle. loy simply shifting the sound box abont its center, thereby changing the angle of the bearing of the needle on the face of the record, and further. such shifting or change in angle of bearing of the needle is an important feature in the proper operation of the sound reproducer.

Referring more particularly to the drawings, I provide a preferably circular plate 15) which has a substantially central orifice, a crlindrical extension 16 encompassing the
o orifice and serving to attach the plate to a sound tube or other conduit for transmitting the sounds reproduced from the record. The cylindrical sound box casing 17 is arranged adjacent to the plate 15 at the side thereof 10 remote from the extension 16, and is secured thereto by means of adjustable screws or studs 18 which extend through oppositely positioned slots 19 in the plate 15. The slots 19 constitute ares of a circle having its cen-
15 ter at the center of the plate, and thus permit the sound box to be rotated with respect to the plate. The latter has an arm or upward extension 20 provided with a nose 21 adapted to engage a series of teeth
20 or indentations $21^{\text {a }}$ at the upper rim of the sound box to hold the same in position relative to the plate. The arm 20 has a stud 22 by means of which it can be conveniently manualiy operated. The somed box has a 25 preferably nuamental knob or button 23 by means of which it can be grasped and adjusted. The sound box is open at the front, and near the open edge has an annular interior groove 24 in which is seated an an-
30 nular cushion 25 preferably of circular cross section and fashioned from resilient material such as rubber or the like. A diaphragm ring 26 having an annular groove 27 , encompassing the same, is arranged within the 35 sound box and cugages the cushion 25 at its groove 27. In this way the diaphagn ring is resilicutly and movably mounted within the somul box. At the front, the diaphagm ring has an inwardly disposed an40 mimar flange 28 against which seats a retaining ling 29) having an inwardly disposed flame 30 at right angles thereto, and a second inwardly disposed flange 31 which is inclined at an angle with respect to the flange 45 30. 1 second, similar ring 29 is arranged opposite to the first riug with its flange 31 adjacent to the corresponding flange of the first ring. I diaphragm 32 is located between the retaning rings e! and is clamped 50 in place intermediate the fanges 31 of the maininger ring. An anmbar locking member :3:) is locented against the flatige 31) of the inHer retaining ring en and holds both these pings in place. The diaphagm ring at How 55 imner edge has inwardly extemding fingers :3 which engenge the locking member $3: 3$ and hold the same in pusitimn. The retamings riness may le of rublere or othere resilient ma(erial.
60 Armanged at the muler sithe of the somend box rasing is at cmalle plate sin, cmerel to conform to the ex mather of the wall of the somblons, and having interposied between it and the sommd bex at smitally formed re-
rubber or other cushion material. The cradle plate is secured in place by means of thumb-nuts or screws 37. having rubber or other cushion washers or buffers 38 separating them from the plate, the latter being provided with suitable openings for the passage therethrough of the thumb-nuts which enter suitably threaded openings of the sound box. A substantially V-shaped yoke 39, is positioned at the rear edge of the cradle plate 35 , and has one arm 40 secured to the edge of the cradle plate by means of a pisot pin 41. The other arm 42, at the end has a slotted extension 43 which receives to the edge of the cradle plate by means of which the yoke can be secured in any one of a plurality of positions. Near the center. the yoke has a bearing t5 in which is journaled a roller 46 adapted to engage the record $A$ to support the weight of the sound bor. At the front edge, the cradle plate 35 has separated, substantially vertical arms 47 , rigidly secured thereto or integral therewith. The arms have the lower ends iliwardly disposed and slotted for a purpose which will appear hereinafter. The stylus bar is arranged between the arms 47 and includes an upper substantially cylindrical part 48 provided with a threarled opening 49 therethrough. The lower, substantially cylindrical portion 50 of the stylus har. haia threaded stud 51 adapted to be adjustably received by the opening 49. The lower portion 50 of the stylus bar las a milled or burred flange or rim the by means of whicl it can be easily adjusted. It has further, at the lower end an opelling or recess is to receive the recording or reproducing, point or needle 54. At one side the portion io of the stylus bar is cut away to form a dat face 5 on whech is laterally extemberl. I piu 56 is pivoted upon the face 5 is and hats : slotted head at by means of which it can he adjusterl. A flat, sumatamtially helieml. resilient uember is is arranged npen the pin $5(f$ and has rigid therewith an arm an secured in place by means of rivels (i) or in any other comvenient mamer. 'The member as lats the cond or part lit lroen at that in :1 predelermined position of the member in it
 hat to (lamp on himi the meedle on paint in prestion withon the unening ins. The ar ramement is surl that when for alom is is downamally disposed a needle or proint em tre inseded freely in the opnomine tais. The
 the dintame to which the meedle we pomil shatl be inserned into the uxening of the

 :a) that the lattor remains maform. B3:
 sis is turnes to hring the patit bow the opxaning tis to elamp the peint in place.

The stylus bar portion 48 has opposite, laterally extending wings 62 either rigidly secured thereto or integral therewith. At the ends, the wings are slotted and receive s the extremities of strips 63 of resilient material such as spring metal or the like. The lower ends of the strips are secured in the slotted inwardly disposed ends of the arms 47. Rivets 64 or the like serve to hold the exrestur or strips in pre. In this the stylus bar is mounted upon the sound box so that it is free to swing in predetermined directions, while it is firmly held against upward. lateral, or torsional morements.
15 The points of flexure of the strips can be determined by providing notches 65 in the sides thereof, which may be located where necessary or desirable. It will be understood that the stylus bar is freely movable the plane of the diaphragm, while it is held against morements in other planes.

The stylus bar portion 48 has an upwardly extending rigid stylus arm 66. pref- word bincated and curving inwardy ward the center of the diaphragm 32. Near its upper end the sides of the stylus arm join to form a part 67 extending outwardly to a point remote from the diaphragm a arm. A further part 68 is disposed inwardly toward the diaphragm and is substantially parallel to the part 67 , forming with the same, a narrow slot 69 . The parts wite at normally right angles with respect to the diaphragm, the part 67 being more attenuated than 68, so that it can bend freely. The part 68 terminates in a substantially bell-shaped enlargement To, havplate 7 万, to secure the latter. the diaphragm and the stylus arm, firmly though resiliently and flexibly together.
A bracket it fashioned from resilient metal or the like and having the ends 78 lifurcated. is mounted upon the rim of the somud box by means of the ends, which bind ing a flat face provided with a recess 71 and having, further, an opening 72 connected with the recess 71 . The diaphragm 32 has a substantially central opening 73 , through which passes a double, flexible member 74 consisting of an annealed copper wire or other suitable line. The flexible member extends throngh the recess 71 into the opening 72 , and through further openings, to the outside of the enlargement 70 , about which it is looped. A plate is is arranged at the side of the diaphragm remote from the strlus arm and has two converging openings 76 therethrongh. each of which receives one rinn of the flexible member 74 and which 5 terminate together at the opening 73 of the diaphragn. The runs of the member are twisted together at the outer side of the or grip the edge of the sound box. Inter-
mediate its ends, the bracket carries a clip 79. The clip has the sides provided with inwardly extending flanges 81, and at the bottom has a series of projections or ribs 82. The sides have portions cut away to form fingers 80 , which are rearwardly disposed and curved to engage in suitable openings provided therefor in the bracket 77 . One of the fingers 80 is longer than the other, whereby the clip can be mounted at an angle with respect to the bracket. A shank 83 is arranged slidably and adjustably within the clip and is held frictionally in place. At the lower end it is bifurcated and has arranged between the bifurcated parts a brush or scraper 84 faslioned from soft rubber or other material suited to the purpose. The scraper engages the record as the latter is rotated, in adrance of the needle point, and thus cleans the record and remores dust or other foreign bodies which would tend to interfere with perfect contact between the needle point and the sound grooves. The shank is arranged at an acute anole, so that the engagement of the scraper with the record is at a similar angle to the line of rotation. The scraper also steadies the record while it is moring.
I prefer to form the diaphragm from a plate of mica, and a plate of like size and form, of a metallic foil cemented, under pressure, to the mica. If desired, a sheet of paper or similar material can be cemented intermediate the sheet of mica and the foil. I have found that a diaphragm of this construction, that is. of combined plates of mica and metal foil, or of mica, metal foil and paper, possesses superior resiliency and tonal qualities. and admits in its construction, of the utilization of a grade of material which has hitherto not been found suitable for this purpose.
In Figs. 11 and 12 is shown a means of modified form for mounting the stylns bar in position upon the sound bor. In this form of the device I provide a block 85 having a threaded opening 86 therethronglh adapted to receive the stud 51 of the lower strlus bar portion 50 . The styhns arm 66 is rigid with the block 85. The latter has openings 87 and 88 therethrongh at the upper and lower portions respectively. The openings 87 and 88 extend through the block from side to side, encompassing the central opening 86. At each side of the block are arranged tension plates 89 having inclined apenings 90 therethrongh. Lines or cords 91 are arranged in the openings 87.88 and 90 and are crossed intermediate the block and the tension plates 89 . The arms 47 have openings 92 through which the cords 91 pass. The latter are secured at the outer sides of the arms 47 by means of set screws 93. Adjusting screts $9 t$ are arranged in suitable openings of the arms 47 , and have 130
constricted ends 95 upon which are arranged tapered rubber jackets 96 engaging in correspondingly formed recesses 97 of the tension plates. In lieu of such jacketed
5 screws I may cushion the recesses 97 . The adjusting screws have the ends slotted and are provided with adjusting nuts 98 at the outside of the arms. By means of the adjusting screws the plates 89 can be moved
10 array from the arms to spread the cords or lines to regulate the tension of the same. It will be understood that in this way the stylus bar is held so that it is free to move in a plane substantially at right angles to the
15 plane of the diaphragm, but is firmly held against upward, lateral and torsional movements. The openings 90 of the tension plates are inclined toward the blocks 85, while the upper openings 88 of the latter 20 are downwardly inclined.

The fact that the stylus bar comprises relatively movable parts 48 and 50 and can be lengthened or shortened by the adjustment of these parts permits the sound box to be
25 used for the purpose of reproducing from and producing of sound records. When used for reproducing sounds it is desirable to have the greater length of the stylus bar between the fulcrum and the center of the
30 diaphragm, to magnify the movements of the needle point when they are transmitterd to the diaphragm. On the other hand, when the device is being used for making a record it is desirable to have the movements of the
35 recording point relatively larger, and the stylus bar is then lengthened for this purpose, by screwing the part 50 in the proper direction. The latter part is free to move in the direction of its length as it has no
40 connection with the sound box other than that through the part 48.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent:

1. In a device of the class described, a sombl-box, a ring therein, a diaphragm within said ring, and an annular momber encircling said ring and serving to suspend and retain said ring movably within and ont
50 of contact with said sombl-hos, said member being fashioned from resilient material.
2. In at device of the class described, a somen box, a diaphagen ring within said somnd bore a solid ammlar resilicut member
55 between said somd box and said ring and forming a chshion moment for said ringe, retaining rings within snid diaphagm ring, a diaphagm between said retaining rings, and means for holding said redaming rings
60 rlamped together to secmere sald diaphragim in plate.
3. In a devies of the chass deseribed. "1 sulsistmatially cylimbrical sommed hex having an internai ammar rewose, a diaphagrm
annular recess, an annular member of resilient material engaging sairl recesses to mount said ring within said sound box and to permit a limited cushioned morement of said ring, and a diaphragm mounted to vi- in brate within said ring.
4. In a device of the class described. a sound box, a diaphragm ring within said sound box and having a cushioned engagement therewith whereby said ring has a limited bodily morement, said ring having an inwardly extending flange, a retaining ring within said diaphragm ring and resting against said flange, a second retaining ring within said diaphragm ring, said retaining rings having inclined flanges at the adjacent edges, a diaphragm arranged between said inclined flanges of said retaining rings, and a locking ring engaging one of said retaining rings to secure said retaining rings in position, said diaphragm ring having projections engaging said locking ring to secure the same in place.
5. In a device of the class described. a substantially cylindrical sound box haring 90 an internal annular recess, a diaphragm ring within said somd hox and having an annular recess, an annular member of resilient material engaging said recesses to mount said ring within said sound box and to permit a limited cushioned movement of said ring, said ring haring an inwardly extending flange, a retaining ring within said diaphragm ring and resting against said flange, a second retaining ring within said diaphragm ring, said retaining rings having inclined flanges at the adjacent ellyes a diaphragm arranged between satid inclined flanges of said retaining rings and a locking ring engaging one of said retaining rings to secure said retaining rings in position, said diaphragm ring having projections engaging said locking ring to secure the same in place.
6. In a device of the class desmibed, a 110 plate having a substantially centa:al openinge a somed hox rolatable with respect to sald plate and having an opening registering with said upening of with phate a diaphagm within said somm box, a styms hat carrical be sad somd box and controlling said diaphagm, satid stys bar heing adaphad to receive a recording on a repronhemer needle, and : spring arm ons salid plate ami engaring salid box to hohld the same in an pharatity of pesitions with respert to saticl phate.
7. Th a devier of the chase desmithed, "1 phate havinge a sulstantially contront oprent


 said phate :at eath side of its central aprening has ing anred slots, stads projocting theongh snid slots mud rigid with satid somm

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box, said sound box haring an opening a dapted to register with said opening of said plate, said plate having an extension adapted to engage said sound box whereby the latter

## 5

 can be held in a plurality of positions, a diaphragm within said sound box, and a stylus bar controlling said diaphragm.8. In a derice of the class described, a sound box, a diaphragm therein, a cradle enshioned upon said sound box, arms rigid with said cradle plate, a stylus bar controlling said diaphragm, and flexible strips parallel to the plane of said diaphragm and connecting said stylus bar and 15 said arms.
9. In a device of the class described. a sound box, a diaphragm therein, a cradle plate cushioned upon said sound box, arms rigid with said cradle plate and haring in-
20 mardly disposed portions provided with slots, a stylus bar having laterally extending wings provided with slots, and flexible strips haring the ends secured in said slots respectirely, of said wings and said arms.
10. In a device of the class described, a sound box, a diaphragm therein, a cradle secured to said sound box, a stylus bar controlling said diaphragm, and separate flexible strips connecting said stylus bar and said
30 cradle, said strips having sharply defined edge recesses medially located.
11. In a device of the class described, a sound box, a diaphragm therein, a stylus bar morably carried by said sound box and
35 controlling said diaphragm, a yoke pivoted upon said sound box and adjustable with respect thereto, a roller carried by said yoke and adapted to engage a record to support said sound box, and means for adjusting
40 said yoke.
12. In a derice of the class described, a diaphragm, and a stylus bar in-curred toward said diaphragm and having at the end adjacent to said diaphragm a part extend-
45 ing outwardly therefrom, and a further part extending intwardly toward said diaphragm, said parts being substantially parallel and forming a narrot slot therebetween at substantially right angles to said diaphragm.
50 said parts in length exceeding the width of said slot.
13. In a derice of the class described, a sound box, a diaphragon therein, and a stylus bar mounted upon said sound box and hav-
55 ing an arm incurred toward said diaphragm. said arm at the end adjacent to said diaphragm being outwardly and inwardly disposed whereby an outward extension is formed having a narrow slot there-
60 in . said outward extension extending to a point remote from said diaphragm a distance greater than any other part of said stylus bar, and excceding in length the width of said slot.
14. In a derice of the class described, a 65 stylus bar, a flexible member engaging said stylus bar, a diaphragm haring an opening, said flexible member extending through said opening to the side of said diaphragm remote from said stylus bar, and means for securing said flexible member at the side of said diaphragm remote from said stylus bar.
15. In a derice of the class described, a dianhragm, a stylus bar having at the end adjacent to said diaphragm an extension, said diaphragm haring an opening therethrough. a flexible member engaging said extension and passing through said opening of said diaphragm, and a plate at the side of said diaphragm remote from said stylus bar and haring openings therethrough, said flexible member passing through said openings of said plate and being twisted to secure said plate, said diaphragm and said stylus bar together.
16. In a derice of the class described, a stylus bar having an opening to receive a needle, and a face adjacent said opening, a helical member rotatably mounted upon said face and haring a part adapted to project orer said opening when said member is in a predetermined position, and an arm controlling said member.
17. In a derice of the class described, a stylus bar haring an opening adapted to receive a needle, means for clamping the needle in said opening. and an arm controlling . said clamping means, said arm, when said clamping means are inoperative, being arranged in a position such that it constitutes a gage for determining the insertion of the needle into the opening of said stylus bar.
18. In a derice of the class described, a strlus bar haring an opening adapted to receive a needle and provided with a flat face adjacent said opening, a pin rotatably mounted upon said face, a helical member loosely mounted upon said pin and having a part adapted to project over said opening to clamp the needle in place, and an arm controlling said member, said arm constituting a gage to determine the depth of insertion of the needle into said opening.
19. In a device of the class described, a diaphragm comprising a sheet of mica, a sheet of metal foil, and a sheet of paper interposed therebetiveen, said sheets being cemented together under pressure.
20. In a derice of the class described, a sound box, a diaphragm ring therein, a solid amular cushion between said ring and said box. annular resilient members in said ring, said members having opposite flanges angularly positioned with respect to each other, and a diaphragm held between said flanges.
21. In a device of the class described, a sound box, a diaphragm ring therein, an



annular member encompassing said ring and consisting of a solid, resilient material whereby said ring has a cushioned engagement with said box, annular resilient members in said ring, said members having opposite flanges angularly positioned with respect to each other and extending toward each other, and a diaphragm held between said flanges.
10 22. In a device of the class described, a rotatable sound box, means on said box wherely the same can be manually adjusted to positions for reproducing and recording, a diaphragm within the sound box, and a
15 stylus bar controlling said diaphragm, said stylus bar being rotatively extensible below the fulcrum point thereof.
22. In a device of the class described, a sound box, a diaphragm therein, a stylus
20 bar controlling said diaphragm and movably mounted on said box, said stylus bar having self contained means for providing
a greater leverage below than that above the fulcrum.
23. In a derice of the class described, a 25 sound box, a diaphragm therein, a stylus bar controlling said diaphragm, said stylus bar comprising a female section movably mounted on said box and fulcrumed thereon, said female section being inextensibly secured to said diaphragm, a male section in rotative engagement with said female section and operative therein to lengthen said stylus bar, said male section having means for holding a reproducing or recording 35 needle.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

## WILLIAM ALBERT CHAPMAN.

Witnesses:
J. E. Moore,
L. H. Katser.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."
A. E. SPENCER \& F. C. THOMAS. MEANS FOR AUTOMATICALLY ARRESTING TALKING MACHINES. APPLIOATION FILED KOV. 22, 1910.
998,807.
Patented July 25, 1911.


# UNLTED STATES PATENT OFFICE. 

ARTHUR E. SPENCER, OF SAN FRANCISCO, AND FRANK C. THOMAS. OF MILL VALLEY, CALIFORNIA.

MEANS FOR AUTOMATICALIY ARRESTING TALKING-MACHINES.

998,807.
Specification of Letters Patent. Patented. .niy 25, 1911. Application filed November 22, 1510. Sexial No. 593,636.

## To all whom it may concern:

Be it known that we, Artititr E. Spencer and Frank C. Thomas, citizens of the United States, residing, respectively, at Gan
5 Francisco, in the county of San Francisen, and Mill Valley, in the comnty of Marin and State of California, have invental new and usefu! Improvements in Means for Antomatically Arresting Talking-Machines,

One object of the invention is to provide
a device for accomplishing this and which will not necessitate any change in the form or construction of the recond itself or in the mote of using the talking machine.
I furtler object is to provide sucle a device of a very simple construction.

In the accompanying drawing, Figure 1
is a broken plan view of a talking machine equipped with our invention; Fig. : 25 is a broken side view thereof; Fig. is is a letail cross section on the line $3--3$ of Fig. 1 ;
Fig. 4 is a detal rentical section on the line tail cross section on the line 3 -- 3 of Fig. 1 :
Fig. 4 is a detail rentical section on the line a-a of Fig. 1 ; showing the positions of the parts when the tone tube is elevaled; Figg. is the parts when the tone tube is lowered to its operative position; Fig. 6 is a smalar view showing the positions of the parts when the tone tube is also in the lower posi35 tion hut the pin has antived at the end of the recorrl.

Referring to the drawing, mpon the thinnble 1 which semmes the tome tube $\because ?$ to the sommel fube ? is rigidly secomed as by seroms
40 4, an anm 5, lrom H1, and ol whisl A(o-
 is a small boacket 7 , lomern with a socku is
 10) in which e:an silislo a roml 11 tho eml of 45 sald rowl having al head (2 and sald rod hav-

 'The rox is llatlemed where it passe thongh the bexrines, so that it ammot tmon blemoms,
50 and the ball hats 11 pin 10 in a sot 11 in tha lomeker to prevont the lominer ol the lall alome all axis parallol will the ranl. Salal

 restiing the retation of a talking machine antomatically upon the stoppage of the sounds proditced by the talking macbine. is a smilar view showing the positions of

lower end 15) is formed with a bearing $1+$ in 55 which is secured a small jliece of catent is the lower end 16 of which proforabliy iipery to a fine point. Said bearing $1+$ is so formed that the catgut can easily be removed and a new piece inserted therein when necessar:

The loop 6 tapers toward the lower end, so that, when the tone tube is raiserl, the rod 11 passing through said loop 6 , rests in said lower end therent and when the stylns 17 of the talking machine is lowered on to the record 6 35. the end 16 of the catgut assmmes a position slightly nearer the center of the record than the enst of the strbus 17. IVhen the catgut descends into contact with the record. it. and the rod 11, are smpported ly the reeord, To but the loop 6 can drop al sliort distance lower, so that the rod 11 no lonerer contacts with said loop. but assmues a po-ition centrally thereof, as shown in $\operatorname{rig}$. 4. When the rod 11 no longer rests in the bottom of the loop, the catent would. hin for the groose in the record. be shifted by the rotation of the record in a tamsererac or radial diesetion orer the record. nutil the roml 11 assmmed a tangential position with redoremes sor to the circle described on the rerom her tha lower end of the catght, and before it arrived at this position the lemring 11 wonld
 of the record beine growned. this rentl denes not rake place. lur the valewit is, low the weight of the rod 11, held in the anmed-producing spiral grouse in the record intor which it dropped, and, as before stated, is slightly nearer the center than tha sislasi 17. amd, in the metation ol the rewort. it is comb
 within, or in ackallo of. the sty his. Hon


 moving inward mo lonero (‘ximiner. Tho stylns 17 continnos to follon thas spiral










wire 23 to a galranic cell $2 \pm$ preferably contained in the box of the talking machine. Since as commonly constructed the reproducer 21 is supported upon the tone tube 2 electric circuit is not closed by said tone tube. In this circuit is an electro-magnet 25 which attracts an armature 26 on a stem 27 sliding in bearings 28 and which carries a at present to operate the brate 31 of the bre br of the talking machine. When said lever is actnated, it breaks a contact in the circuit 20 , consisting of said lever 30 and a bent wire 32 secured to the electro-magnet. When the brake 31 is removerl, said contact is again closed by the lever, and the circuit 20 is open at the stylus and catgut holder, and is adapted to be closed in the same manner as before. When the tone tube is raised for use with another record the arm 11 drops into the tapering lower end of the loop 6 , and the holder is therefore out of electrical connection with the stylus. also said arm slides back in its bearing until the collar abuts against the bracket so that the catgut is out of the way when removing the stylis and replacing it by another.

We do not confine our invention to the arrangement here shown in which the stylus itself closes the electric circuit controlling the brake, as this electric circuit may be closed by contact of any parts moving respectively with the catgnt on the one hand and the stylus on the other. Nor do we limit our invention to the means here shown for producing said relative motion, said means being the oblique arrangement of the rod 11 to the arm carrving the stylus, as any posi- tive means could be employed to produce this relative movement when permitted to
do so by the arrival of the catgut at the end of the spiral recording groove.

We claim :-

1. In combination with a rotating record
having a record groove, a talking machine having reproducing mechanism, a device engaging the groove in adrance of the reproducing mechanism, an electric circuit, means movable respectively with said device and said reproducing mechanism and connected to opposite sides of said circuit to close the circuit by contact with each other due to a movement relative to one another of said reproducing mechanism and derice, an elec-tro-magnet in said circuit, and a brake for the record controlled by said electro-magnet, sulustantially as described.
2. In combination with a rotating record haring a record groove, a talking machine having reproducing mechanism, a holder carried by said talking machine, a filament carried by said holder and engaging the groove in adrance of the reproducing mechanism, an electric circuit, means movable with said reproducing mechanism, said means and said holder being comnected to opposite sides of said circuit to close the circuit by contact with each other due to a movement relative to one another of said reproducing mechanism and holder, an electromagnet in said circuit, and a brake for the record controlled by said electro-magnet, substantially as described.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

> A. E. SPENCER.
> F. C. THOMAS.

Witnesses:
Fraxcls M. Wright, D. B: Richards.

## M. COUADE.

ARRANGEMENT FOR CONTINUOUS PHONOGRAPH RENDERINGS, APPLIOATION FILED MAR. 23, 1909.
999,097.
Patented July 25, 1911.
Fig. 1.


Fig. 3.
$m$


# UNITED STATES PATENT OFFICE. 

MAAURICE COUADE, OF LAON, FRANCE.
ARRANGEMENT FOR CONTINUOUS PHONOGRAPH RENDERINGS.
$999,09 \%$.
Specification of Letters Patent. Patented July 25, 1911. Application filed March 23, 1909. Serial No. 485,225.

## To all whom it may concern:

Be it known that I, Maurice Couade, a citizen of the French Republic, residing at Laon, Department of Lisne, France, have
5 invented a new and useful Arrangement for Continuous Phonograph Renderings, of which the following is a full, clear, and exact description.
This invention relates to an arrangement 10 whereby may be obtained the continuous rendering or reproduction of a piece of music or the like recorded on several successive disks or cylinders. This arrangement also enables me to effect as desired with ab-
15 solute certainty and without jerks, the starting and the stopping of the gramophone or phonographic rendering of a piece, at any desired point in this piece and at a predetermined moment.
20
Means for carrying out the present inrention are shown by way of example upon the annexed drawings, in which:-

Figure 1 is a longitudinal section, and Fig. 2 is a section on line $1-1$ of Fig. 1.
25 Fig. 3 shows an example of the arrangement applied to a cylinder apparatus.

A horizontal axis a turning between two supports or bearings B and $\mathrm{B}^{\prime}$ transmits by the intermediary of two tangential screws
$30 C^{\prime} \mathrm{C}^{\prime}$ and two wheels D $\mathrm{D}^{\prime}$, the movement of a constant speed-motor (not shown) to two plates E E'. The vertical spindles $\mathrm{F}^{\prime} \mathrm{F}^{\prime}$ of the plates can slide in the wheels which drive them, by means of keys $G G^{\prime}$; by rea-
35 son of this arrangement the wheels alome receive the oblique drive of the helicoidal gears and the vibrations from this wheel are not imparted to the plates E E' F'. These wheels D I)' may be monnted between ball 40 bearings carried by the bearings $133^{\prime}$.

The two tamgential serews ( $C^{(0}$ have theads of opposite hands; the same applies to the wheels 1) D', the object being to hatance the thrust of the wheels in the diere-
45 tion of the axis 1.
The spindles $\mathrm{F}^{\prime} \mathrm{F}^{\prime}$ rest $\quad$ upon the extremities of two pistoms II I!' gnided vertically
 ried by the extremities of a beam I which
50 can oscillate abont a horizontal axis passing throngh its center, in the mamer of a scale beam. This beam is balameed moder the weight of the two disks, evol when the lattor are in movement mad as shght pressmer
55 mpon one of the nems is sulficicnt. Wo lower the corresponding disk while the other is
raised. This rocking is produced from a distance by the two small electro-magnets for the two directions.

Around each disk is fixed to the casing of 60 the apparatus a crown $\mathrm{L} \mathrm{L}{ }^{\prime}$ which serves as support to the disk at its edges, when the disk is lowered; it also allotrs of centering it in such a may that the hole in the disk is exactly facing the end of the disk-spindle 65 and it maintains it at about a millimeter from the disk.
The working of the apparatus is as fol-lows:-The motor being started and the excited electro-magnet K maintaining the plate E lowered, the disk M is laid npon the crown L and alined so that the needle of the reproducer ${ }^{\text {N }}$ rests upon the point of the spiral which corresponds to the point at which the reproduction begins. At the moment when this reprodnction is to begin, the pivoting of the beam is effected by the elec-tro-magnet mechanism; as soon as the plate E in rising comes into contact with the disk M, it raises the latter from its support or so seat $L$ and revolves it in its own movement. The reproduction then begins immediatel: During the reprodnetion of this first disk, the succeeding disk $\mathrm{MI}^{\prime}$ is plared upon the crown $L^{\prime}$, as before its reprodncer $N^{\prime \prime}$ being arranged at the point of the spimal which the rendering is to begin. It the coment moment one changes over from the reproduction of the first disk M to that of the second disk $\mathrm{IN}^{\prime}$ by throwing owe the he:m. There happens in the calse of the disk $\mathrm{II}^{\prime}$ the same as deseribed for the disk M. While He plate E in falling drops its disk $1 /$ unom the crown L , which canses its insant stop) page. These uperations are repeated. The 95 adhesion of the disk to the phate which takes place ore the lower surface of the disk ame the athesion to the cerow which takes plame at the edges of the disk are facilitated by the interposition of hai\%e or any other smbamen prewnting the slipping of the disk, ase well as by the mombless of the lonere and fate of the disk. The phate te is mate sumberionly
 spred of Ha metor witing to the sudtan in "remse of weight added thereot by the com paratively light disk at the meniont of ell gaterment. The combitence of the releman of one disk with the cogragroment of the other
 nuce in the speal.

The invention is mot limited to the dedaik
of construction given above merely by way of example. For instance the movement of the disks instead of being obtained through the rocking of a lever may be secured by any 5 other suitable mechanical or electrical contrivance.

If it be desired to apply the arrangement to a cylinder apparatus, the plates $\mathrm{E} \mathrm{E}^{\prime}$ might for example be replaced by the conical sleeves employed in cylinder phonographs (e Fig. 3), and arrange the apparatus in such a way that the axes A F $\mathrm{F}^{\prime}$ are horizontal.

The cylinders rest upon supports $l l^{\prime}$ which allow the cylinders to be centered; before the reproduction they sustain the cylinder, having its reproducer placed at a suitable point, at a very small distance from the sleeve.

The support $l$ which is fixed will allow of detaching the cylinder at the moment of release; the support $l^{\prime}$ which is pivoted will allow of insuring the adhesion between the sleeve and the cylinder at the moment of engagement, and then by its pivoting or tilt- ing action, which follows immediately, of releasing it completely.

Having thus described my invention, what I claim as such and desire to secure by Letters Patent is:-

1. A phonograph having stationary supports for two records, means for simultaneously lifting one record from and depositing another record upon its support and means in connection therewith for rotating only the lifted record for the purpose described.
2. A phonograph apparatus having stationary supports provided with means for centering records thereon, in combination with rotary supports adapted to lift the records from said stationary supports and means for imparting vertical movement in opposite directions to said rotary supports whereby a record may be lifted from one stationary support while another record 45 is deposited on the other stationary support, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

MAURICE COUADE.
Witnesses:
Charles Douy, Jules Devine.

## B. F. PHILPOT.

MOLDING MACHINE FOR CYLINDRICAL PHONOGRAMS. APPLICATION FILED FEB. 12, 1910.
999,183.
Patented July 25, 1911.


# UNITED STATES PATENT OFFICE. 

BRIAN F. PHILPOT, OF BROOKLYN, NEW YORK.<br>MOLDING-MACHINE FOR CYLINDRICAL PHONOGRAIMS.

999,183.

Specification of Letters Patent. Patented July 25, 1911.

Application filed February 12, 1910. Serial No. 543,530.

## To all whom it may concern:

Be it known that I, Brfan F. Philipot, a citizen of the United States, residing at Brooklyn, in the county of Kings and State
5 of New York, have invented certain new and useful Improvements in Molding-Machines for Cylindrical Phonograms, of which the following is a specification.
My invention relates to improvements in the or molding presses for turning in the ends of tubes or cylinders used in making phonograms in accordance with the process disclosed in my application Ser. No. 543,529 filed February 12th, 1910. which will support the extremely thin wall f 1 of the tube and smoothly turn the ends in between the dies which are maintained at a pre-determined distance apart while the molding operation is being carried on.
In the drawing Figure 1 is a view of the complete machine, Fig. 2 is a sectional view of the tube holder and molding cap or die, and Fig. 3 shows the end of the tube after it has been turned in.
The machine comprises a base 1 provided with a bearing standard 2 having a bearing box 3 at the upper part. A plunger 4 is actuated by a gear 5. working in a rack on
30 the plunger and reciprocates in the bearing 3 , a handle 6 connected with the gear affording means for reciprocating the plunger. A shelf 7 carries the work holding cylinder 8 which is provided with a base 9 . The
35 shelf is far enongh below the heat of the machine to enable the tubes to be slipped in and out of the cylinder. The inside diameter of this cylinder is slightly larger than the ontside of the tube to be molded. A arel rests inside this cylinder outside diancter is slightly less than the inside diameter of the twhe heing molded. This mandrel consists of a differential phog 10 resting on the base 9 and has a spring ! ${ }^{\prime}$ oud aromd its smat dimmeter. $\Lambda$ sere ond plug member 11 rests on the spring amid is centered on the small diameter of the phar 10. The upper end of this plug 11 is beated or romeded to form a male dio which may
50 bee a separate piece as shown to facilitate renewals. The heating head 14 is attached to the plunger 4 and flexible pipinge if: affords means for comseying stean for kepping the heme hot. A femate die 15 is se male dic 12.

A tube of the material to be molded is slipped into the cylinder with its upper edge slightly showing above the top as shown in Fig. 2. On lowering the heated head and dic the central part 15 ' of the female die strikes the spring supported part 11 of the compoind mandrel and causes it to telescope against the pressure of the spring.

The thickness of the central boss $1 . \mathrm{y}^{\prime}$ do- 5 ; termines the space between the operative faces of the dies which shonld be a few thousandths of an inch more than the thickness of the material being operated upon to enable it to slip freely between the dies and be rolled in and yet prevent wrinkling. The expoced edge of the tube strikes against the flare on the outside of the female die 15 and begins to curl inward over the edge of the male die. On further downward motion of the head the upper part of the mandrel continues to sink and the upper edge of the tube 13 is rolled smoothly between the dies. As the sides of the tube are at all times fully supported hetween the mandrel and cylinder they have no clance to warp, tivist or wrinkle. After the limit of travel is reached the head is raised. the spring lifting the upper member of the mandrel and the tube with its rolled over edge can be removed from the machine.

I claim:-

1. A molding machine for making crlindrical phonogram blanks of celluloid of the like material comprising a frame, tube loheling mechanisma die secmed to the thbr hohding mechanism, a heated head movally socured to the frame al comiter die on the hemal and means for maintaining a predetermined separation between the opreative faces of the dies while they are in mokling position.
S. A mokling machine for makine (elindreal phonogram blanks of eollahoid of the like material comprising a frame a certinder secented thereto, a componmed mandred within the crlinder, the upper member of which is riekfingly smported. In die on the "मper member: a heated hearl, a comber dic ear ried therom, mans for mepmotine able head with resper to the evlimeder whereder the maturial to be mothere will be foreed he: twern the dive Mron the merprocation of the hand, and means for maintaming a prodotominand spandion betwen the oprotion face of the dice whitw the are in mokling pmsition.
2. I moldiner machine for makine celin-
drical phonogram blanks of celluloid or the like material comprising a heated head, a die on said head, means for reciprocating said head, a work holding member alined compound mandrel within said cylinder composed of an upper part which telescopes with respect to the cylinder, and a lower supporting part, the cylinder and mandrel being adapted to hold the tube to be operated upon between them, a counter die on the upper member of the mandrel and means for maintaining a pre-determined separation between the operative faces of 5 the dies while they are in molding position.
3. A molding machine for making cylindrical phonogram blanks of celluloid or the like material comprising a heated head, a die on said head, means for reciprocating said head, a work holding member alining with said head consisting of a cylinder, a compound mandrel within said cylinder composed of a lower part of different diameters, a spring on the small diameter, an upper part guided by the small diameter and resting on the spring, and a counter die on the spring supported member, the cylinder and mandrel being adapted to hold the tube to be operated upon between them; and
means for maintaining a pre-determined 3 separation between the operative faces of the dies when they are in molding position.
4. A molding machine for making cylindrical phonogram blanks of celluloid or the like material comprising a heated head, a die on said head, means for reciprocating said head, a work holding cylinder rigidly supported in alinement with said head, a compound mandrel in said cylinder consisting of an upper and a lower member, the upper member of which telescopes with respect to the cylinder means for yieldingly supporting the upper member, a counter die on the upper member, the cylinder and mandrel being so proportioned that the tube to be operated upon will fit snugly between the cylinder and mandrel and project above the top of the cylinder and slightly above the face of the die, and means for maintaining a pre-determined separation between the operative faces of the dies when they are in molding position.

In testimony whereof I have affixed my signature in presence of two witnesses.

BRIAN F. PHILPOT.
Witnesses:

Robt. B. Killgore,

A. J. Manfred.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
$977681$
M. 0. SMITH.

MEGAPHONE.
APPLIOATION FILED MAR. $31,1910$. 999,408.

Patented Aug. 1, 1911.



# UNITED STATES PATENT OFFICE. 

IMARY O. SMITH, OF AUBURN, IMAINE.

MEGAPHONE.
$999,408$.
Specification of Letters Patent. Patented Aug. 1, 1911. Application filed March 31, 1910. Serial No. 552,666.

## To all whom it may concern:

Be it known that I, Mary O. Sumti, of Auburn, in the county of Androscoggin and State of Maine, have invented certain new
5 and useful Improvements in Megaphones, of which the following is a specification.

This invention has for its object to provide a megaphone adapted to direct sound waves, not only in a forward direction from
10 the operator, but also in a rearward direction, so that sound vibrations transmitted through the megaphone may be heard equally well by persons behind and in front of the operator.
15 The invention is embodied in a megaphone comprising a trunk tube having a mouth piece into which the operator speaks, a forwardly facing horn adapted to direct sound waves forward from the operator, 20 and a rearwardly extending branch tube which is offset from the trunk tube and is adapted to extend across the operator's head or neck, and terminates in a rearwardly facing horn.
The invention may also be embodied in a megraphone characterized as above stated and further characterized by additional branch tubes and sound delivering horns adapted to direct sound waves laterally or 30 toward the right and left of the operator.

Of the accompanying drawings forming a part of the specification,-Wigure 1 represents a plan view of a megaphone embodying my invention. Fiy. 2 represents a sec-
35 tion on line 2-2 of Fig. 1. Fig. 3 represents a view similar to $\mathrm{Fig}, 1$ showing the somid delivering horn removed from the branch lubes, the latter being closed by detachable caps.
40 The same reference chatacters refer to the same parts in all the figures.

In the drawings, 12 represents a tronk tule having at one end a month piere 13 adapted to be applied to the month of the
45 speaker, the trmik tome 12 being adtapted to condere semmed wases from the mond piece.

14 represents a somad delivering horn which is proferably of hapering form as shomon in the drawings, sald hom facing for-
50 wardly son that it is adapted to dired somed Wates formarl form lle sponke.
1.5 reperemts a bund habe which projeds from the tromk tube 19, and projects remmwhrdly und fominales in a rearwardly foc-
55 ing sombl detivering hom 16 . The form and arrangement of the branch tule 15 and
horn 16 are such that the horn is offiset from the trunk tube and is adapted to extend across the operator's head or neck so that sound waves may be directed backwardly from the operator by the horn 16. The branch tube 15 and its horn 16 may be arranged to be supported by a shoulder of the operator, although if only one of said branch tubes is employed it is obvious that the tube 15 and horn 16, instad of being supported by the operator's shoulder, may extend over the top of the operator's head.

As shown in Fig. 1, there are two of the tubes 15 and rearwardly facing horns 16,70 these being located at opposite sides of the trunk tube 12 , so that when the device is in use the two branch tubes 15 and their horns may be supported by the shoulders of the operator.
17 represents laterally projecting branch tubes terminating in horns 18,18 , said branch tubes and horns being arranged to deliver some waves laterally toward the right and left of the operator. 19 represents another branch tube which may be employed in comection with the two branch tubes 1.5 and is arranged to extend upwardly and backwardly over the top of the operator's head, said branch tube 19 terminating in a rearwardly facing horn 20.
It will be seen from the foregoing that provision is made for directing sound waves simultaneously forward, backward, and laterally from thic operator, so that persons behind and at either side of the operator may hear with the same facility as those localed in front of the operator.

In Fig. 3 I have shown the horn distine from atl the branch tubes, the hatter being 95 closed by removable caps 21 so that somid wayes are directed only by the forwardly: facing hom 1\%.

It is olvions that the horn it may be detachably comected with the trmak tube to 100 cmable the megaphome to orempy a simall ppace when packed.

Tho branch lubes 1 and inde chlow-shaped extensions $15{ }^{\circ}$, the miler members of which arn sulstantially pmatled with Hue trank 105 tulo 19. The salu ratensions may be matatble on the body or intaer pertions of the brand tulves 10. so that, the extensions and He hom camied theredoy may be extembed at dillewent mates mad dired the sommed waves cither horizontally of at any desired angle.

The various sound-delivering horns may be of telescopic construction for the sake of compactness in packing, but as telescopic horns are common and well known, I do not construction.
I do not limit myself as to the number of branch tubes and horns, and as already stated, I may employ either one or more rearwardly extending branches and rearwardly facing horns. If desired, the laterally extending branches 17 and horns 18 may be omitted, or only one of these branches and accompanying horns may be provided.
The forwardly facing horn 14 may be removed and the outer end of the trunk tube closed by a cap 21, to enable all the sound waves to be directed through one or more of the branches should this be desirable.

The device being a megaphone is of course portable and, like megaphones in general, is intended to limit the transmission of the sound waves to substantially horizontal directions. Owing to the fact that there is one sound receiving branch and a plurality of sound distributing branches, all of which are rigidly connected and extend in different horizontal directions, the device is especially adapted for distributing the voice of a speaker who may stand within an audi-
torium or a race-track or ball-field, or wherever announcements are to be made in connection with athletic sports. The device enables the speaker to make himself heard equally well by people scattered in various directions. If the audience is not extensively distributed, the user can remove one or more of the delivering horns 14,16 and 18 , and apply caps to the tubes from which the horns were removed, thereby readily conrerting the device to the form best adapted for the particular audience to receive the announcements.
I claim :-
A megaphone comprising a trunk tube provided with a mouth piece at one end, a sound delivering horn at the other end, and intermediate branch tubes, elbow extensions rotatably secured to said branch tubes, the outer members of said extensions being normally parallel with said trunk tube, and sound delivery horns connected to said outer members and adapted to rest upon the shoulders of the operator to balance the 55 megaphone and aid in supporting the latter.
In testimony whereof I have affixed my signature, in presence of two witnesses.

MARY O. SMITH.

Witnesses:<br>Dawn B. Jeffery,<br>Forest E. Ludden.

C. O. HAYS.

PHONOGRAPE.
999,645.
Patented Aug. 1, 1911.
2 Sheets-sheet 1.


Witnesses.
estarry O. Rastetter!
Ruth C. Miller


# UNITED STATES PATENT OFFICE. 

## CHARLES O. HAYS, OF LOCUST CORNER, OHIO.

PHONOGRAPH.
$999,645$.
Specification of Letters Patent. Patented Aug. 1, 1911. Application filed September 1, 1910. Serial No. 580,107.

## To all whom it may concern:

Be it known that I, Charles O. Hays, a citizen of the United States, residing at Locust Corner, in the county of Clermont
5 and State of Ohio, have invented certain new and useful Improvements in Phonographs, of which the following is a specification.

The invention relates to attachments for 10 phonographs by means of which both disk and cylinder records can be used on cylinder machines. By the use of these devices both styles of records can be played with equal convenience and very little time is required is desired.

The playing of disk records is accomplished by the use of a jointed bracket which is adapted to support a disk turin-table, suittable ant a disk can readily be interchanged with the cylinder record reproducer. But, when cylinder records are to be used, the turn-table is removed and the jointed bracket is folded back out of the way.

A preferred form of the invention is tlustrated in the accompanying drawings, form-

Figure 1 is a front view of a cylinder phonograph, showing the devices in nise with a disk record; Fig. 2 , an end view of the same, showing the jointed bracket in its prone position in dotted lines; Fig. 3, a perspective view showing the machine in mse with a cylinder record; Fig. A, a section on line 4 I, Fig. e2; Fig. 5, a top view of a portion of the base of the phonograph; Fing. a view of the grose-necte, showimg the split labe, forming part therenf, in the position to whtheraw the reprodncer ; and Fig. 7 , a similar view, with parts broken away, showing the grosese-neck commeded to the roproducer:

Similar mmerals refer to similar parts thenghont the drawings.
'The phonograph shown in the dran inges is of common constrution. 'The casing I con
which, by means of the belt 2 over the pulley 3 , rotates the cylinder-record-mandrel 4 . On the same shaft with the pulley 3 is fixed the spur gear 5 , which meshes with the idler 6, which in turn rotates the spur gear 7 . The 55 spur gear 7 is fixed to the worm 8 , which is jommaled in the brackets 9 and $9^{2}$. The guide bar 10 is also supported by the brackets 9 and $9^{\text {a }}$, and thereon is slidably mounted the reproducer frame 11 , to the lower part of which is attached the mit 12, which meshes with the worm 8. Thus, when the worm screw is turned, the reproducer moves parallel to the axis of the mandrel.

When a cylinder record is operated on the 65 mandrel, the reproducer needle (not slown) is vibrated by its contact with the revolving record and sound waves are produced in the reprodncer $11^{a}$ from whence they are conreyed through the goose-neck 13 and the 70 tone-am 14 to the horn $1 t^{2}$. The nut 12 can be thrown open or out of engagement with the worm and the reproducer needle raised from the recort, by slightly raising the con-trolling-lever $12^{2}$, thus simultaneonsly stop)ping the endwise movement of the reproducer frame and the playing of the record: all of which is otd and forms no patit of the invention.
For the purpose of playing disk records a so jointed bracket is cmployed, which indudes the bearing frame $15^{\circ}$ which is jointed to the bats: 16 , which ate hinged to the casinge loy the pivated supperts 17. (On the fromit if the bearing frame is formed or commented the 85 bifineated foot 18 , which is addated ta stand dre the gruide low 10 and thes hold the jointed bracket in a rigid and elevated posi(ion!.

If it is desimed to play exlimer verordo. 90 the jointed bracket is folded hardi out of the

 formard into :an clevated postion, and the
 When the reprondace is moned tonatal the jointed bracked ley lifting the lever IEA, "hach

 the pin lis", which is eommededtothe ferel 15. 100

Then the slaft 19. to whicla is axially fixed the turn-table 20 , is inserted throngh the bearing 21 in the bearing frame and the lower end of the shaft is journaled in the 5 step bearing 22 which is formed in the plate 23. This plate is formed as shown in Fig. 5. and its notched ends 24 embrace the brackets $9^{a}$. which prevent any lateral movement.

Rotary motion is communicated to the
10 turn-table 20 from the mandrel 4 by suitable gearing, the preferred form of which is illustrated. On the under side of the turntable is located the crown wheel 2.5 which engages the spur gear 26 , which fits snugly on
15 the large end of the mandrel. It will be seen that when the mandrel rotates, the gears 25 and 26 will impart motion to the turn-table.
Even though the jointed bracket is not
20 held firmly in position. or if it should be slightly out of its proper position. the spur gear 26 . on account of its wide face, will make allowance of any such irregularity and will mesh with the teeth of the crown
25 wheel just the same. The size of these gears is preferably made such, that the two styles of records can be played at substantially the same speed, thus making it unnecessary to change the speed adjustment.

By turning the thumb screw 27 the crlinder reproducer $11^{2}$, can be remored from its frame. and the goose-neck 13 is then free to be withdrawn from the tone-arm. The disk reproducer 28 is then firmly connected to the
35 tone-arm by inserting its tubular shank $28^{\text {a }}$ into the tone-arm and engaging the pin $28^{b}$ on the shank in the L -shaped slot $14^{\circ}$ in the tone-arm.

There is preferably a pirotal comnection 40 between the goose-neck and the cylinder reproducer and it is sometimes desirible to remore ouly the goose-neck from the machine, and therefore it is made detaclable from the reproducer. This comnection is shown in
45 Figs. 6 and 7 . The split tube $13^{a}$ of the goosse-neck is provided with an internal annular rib 30 which fits lonsely in the anmular groove 31 in the tube $31^{i}$ of the reproducer. On the goose-neck are located the
50 fixed collar :39. the lonse collar 33 and the intervening coiled spring 34 , which is normally expanded, and its respective ends are attached to the collars. When the spring is compressed hy sliding the loose collar upward the split tube $13^{\text {a }}$ is free to expand and the reproducer can be detached as shown in Fig. 6. On the turn-table is the usinal corering of felt $20^{\mathrm{a}}$ and the centering pin $20^{\mathrm{b}}$, on which can be placel the disk record 29 .
When these preparations are made the machine is really to be started and it is operated in the 11:mal manner. It is obrions that no skill is required and but little time is consumed in changing from one style rec-
ord to another. Furthermore. the device 65 can very easily be applied to any machine without requiring it to be sent to the factory. And it is erident that the use of the step bearing is not essential, although the same is preferred because its use renders unnecessary the making of the jointed bracket and its connections strong enough and the bearing therein large enough to hold the axial slaft of the disk table without a step bearing.

I claim:

1. A phonograph including a case with a step-bearing, a cylinder-record mandrel and a reproducer laving a controlling leter thereon: a normally-folded bracket haring a bearing therein on the case and adapted to be secured in an elerated position; a diskrecord table having an axial shaft adapted to be inserted in the bracket-bearing and step-bearing when the bracket is elerated, there being an arm on the bracket adapted to hold the eylinder-reproducer controllinglever out of action when the bracket is elerated; and gearing connections between the mandrel and the table.
2. A phonograph including a case witl a crlinder-record mandrel and a reproducer having a controlling lever thereon; a nor-mally-folded bracket haring a bearing therein on the case and adapted to be secured in an elerated position: a disk-record table haring an axial shaft adapted to be inserted in the bracket-bearing when the bracket is elerated, there being an arm on the bracket adapted to hold the cylinder-reproducer controlling-lever out of action when the bracket is elerated; and gearing comections between the mandrel and the table.
3. A phonograph including a case with a step-bearing and a cylinder-record mandrel thereon, a normally-folded jointed bracket having a bearing therein hinged to the case and adapted to be secured in an elerated position. a disk-record table having an axial shaft adapted to be inserted in the bracketbearing and step-bearing when the bracket is elevated, and a gearing connection betreen the mandrel and the table.
4. A phonograph including a case with a
cylinder-record mandrel thereon, a nor-maliv-folded jointed bracket having a bearing therein hinged to the case and adapted to be secured in an elevated position, a diskrecord table having an axial shaft adapted to be inserted in the bracket-bearing when the bracket i. elerated, and a gearing connection bet ween the mandrel and the table.
万. A phonograph including a case with a step - bearing thereon, a normally - folded jointed bracket having a bearing therein hinged to the case and adapted to be secmrerl in an elevated position, and a table having
an axial shaft adapted to be inserted in the bracket-bearing and step-bearing when the bracket is elerated.
5. A phonograph including a case, a nors mally-folded jointed bracket having a bearing therein hinged to the case and adapted to be secured in an elevated position, and a
table having an axial shaft adapted to be inserted in the bracket-bearing when the bracket is elevated.

CHARLES O. HAYS.
Witnesses:
Doan Beeler,
Amanda Kearns.

Copies of this patent may be obtained for five cents eacl, by addressing the "Commissioner of Patents. Washington, D. C."

C. 0. HAYS.

PHONOGRAPH.
999,646.


Figh 2


Witnesses
Y. FYohl

Muth Cu. Miller
Charles O. J. Cays By Atamy Sicase

# UNITED STATES PATENT OFFICE. <br> CHARLES O. HAYS, OF LOCUST CORNER, OHIO. <br> PHONOGRAPH. 

$999,646$.

## Specification of Letters Patent. Patented Aug. 1, 1911.

Application filed March 13, 1911. Serial No. 614,180.

To all whom it may concern.
Be it known that I. Chinles O. Hiys, a citizen of the United States, residing at Locust Corner, in the county of Clermont and 5 State of Ohin, have invented certain new and useful Improvements in Phonographs, of which the following is a specification.

The invention relates to the combination of a mandrel mechanism with the operatngh, to the ffect that the mondrel graph, to the effect that the mandrel mechanism of any ordinary type of phonograph for the use of cylinder records can be used in connection with the cabinet and operating record phonographs. This general object is accomplished by mounting the mandrel mechanism on a suitable frame adapted to rest on the cabinet of the disk machine around the turn table thereof. and by gearing with the mandrel mechanism a friction wheel adapted to travel on the turn table and to be rotated by the same to actuate the mandrel mechanism.

The invention, thas set forth in general terms, is illustrated in the accompanying drawings, forming part hereof, in which-

Fignre 1 is a perspective view showing a mandrel mechanism mounted on the cabinct of a disk-record phonograph; Fig. 2. an end elevation of the same; Fig. 3, a front elevation of part of same; Fig. $t$, a fragmentary section on line 4-1, Fig. 2; and Fig. 5, a detached perspective view of the compensating levers.

Sinilar numerals refer to smimiar parts thronghout the drawings.

On the calbinet 1 of the disk-record phonograph is momited the nsual tum table 2, and in the calsinet is provided the nsual motor and other operating mechanism (not shown) for rotating the farn table, the same being provided with the nsial brake and reginaltor 3. The tone arma 4 and the horn of are monnted on the bracket of which in thro is secured to the cabinet in the nsital mamere. The mandrel mechanism ind hades the nismal base plate 7 , the standards 8 and sin $^{n}$ therem, the mandeel having its shalt 10 jommaled in the standard s. the gran whed 11 sectured on the mandrel-shaft, and the driving geal whed 12 secomed on the driving shafi $1: 3$ which is jommuled in the bembing 14 formed or secured on the standurd s, which driving gean whel meshes with the
mandrel-wheel 11 on one side and feed gear wheel 15 on the other side; and on the outer end of the driving shaft is secured the pulley wheel 10.

The base plate 7 of the mandrel mechanism is preferably secured to the cross bars 17 which in turn are secured to the rectangular frame 18 which is adapted to rest on the top of the disk-cabinet freely around the turn table therenf, and in this relation of the parts the cross bars 15 and the base plate of the mandrel mechanism are located freely above the turn table. The uscillating arm 19 is piroted at one end on the bearing 14 of the driving shaft 13 , between the standard 8 and the pulley wheel 16 . and is pivoted at the other end to the angle of the L-lever 20 . which lever has its horizontal arm pivoted to the upper end of the י!p)right link 21 , the lower end of which link is pivoted to the hase plate of the mandrel mechanism.

On the lower end of the depending arm of the L-lever 20 is provided the bearing 22 in which is mome the axle 23 of the frietion wheel 24 which is provided with the rubber or frictional tire or periphery $24^{4}$; and ont the side of the friction wheel is secured the pulley whee 25. The belt or band 26 is provided armond the pmlley whels. The U-shaped rod 2 E is pivoted he its yoke 28 on the oscillating arm 19), on ond cmit of which rod is pisoted the idle whes $2!9$ and the other end of the rexd is eommeded tot the arm 19) by means of the spring ? ?

When the mandel merchanism, with its supporting frame is placed inpon the diskcabinet. the parts are so ampanged that the periphery of the friction "heed will reat "pon the turn table 2. preforahly ne: the periphery therent. and he romated her the frictional contant therewith whon the then table is rotated he its opreathing merdamian: and it is er ident that the werllating anon 1!
 whid wollodively may bratlad the rompensating lavers will promit the friction whed torise am! fall toremform to fle variations in the lecight of the furn tuhbe as it
 armarement of the comprosating lerms. that the fridtom whed will rise and fall in a sulbematially vertical line. an that it will
 the rotation of the disk; it is fonthermome
evident that the action of the spring 30 serves to press the idle wheel 29 firmly against the belt 26 at all times, and that as the friction wheel is slightly elevated the s idle wheel will press the belt downward to keep it tightly around the pulley wheels. And it will be understood that when the mandrel mechanism is combined with the disk-cabinet. a suitable connecting pipe as 31 is provided to connect the gooseneck 32 of the reproducer frame 33 with the tone arm. there being a rotatable sliding joint at 34 between the connecting pipe and the cooseneck, and a swivel joint at 35 in the gorel for the of plinder adapted for the use of cylinder records; and that when the mandrel mechanism and corresponding parts are removed. a suitable disk-reproducer (not shown) is secured to net having a rotatable turn table thereon, a frame adapted to rest on the cabinet around the turn table, a mandrel mechanism on the frame, and a friction wheel resting on the
turn table and haring an oscillating gearing connection with the mandrel mechanism.
2. The combination of a phonograph cabinet having a rotatable turn table thereon, a frame adapted to rest on the cabinet around the turn table, a mandrel mechanism on the frame, a friction wheel resting on the turn table and having a gearing connection with the mandrel mechanism. and a bearing for the friction wheel connected with the mandrel mechanism. whereby the wheel is adapted to oscillate with the turn table.
3. The combination of a phonograph cabinet having a rotatable turn table thereon, a frame adapted to rest on the cabinet around the turn table. a mandrel mechanism on the frame, a friction wheel resting on the turn table and having a gearing connection with the mandrel mechanism. and a bearing for the friction wheel having compensating leser connections with the mandrel mechanism, whereby the pulley wheel is adapted to oscillate directly up and down with the turn table.

CHARLES O. HAYS.
Witnesses:
W. J. Tone,

Mermos Shall Trot.

Big. 1


Fieresses:
Frauk D. Keuro Diclos froeden

Allys.

# UNITED STATES PATENT OFFICE. 

HERMAN WOLKE, OF ORANGE, NEW JERSEY, ASSIGNOR, BY IMESNE ASSIGNMENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MECHANICAL MOVEIMENT.

## 999,93\%.

Specification of Letters Patent. Patented Aug. 8, 1911.

Application filed January 3, 1907. Serial No. 350,649.

## To all whom it may concern:

Be it known that I, Herman Woliee, a citizen of the United States, residing at Orange, in the county of Essex and State
5 of New Jersey, have invented certain new and useful Improvements in Mechanical Movements, of which the following is a description.
My invention relates to means for im10 parting a progressive movement to the carriage which carries the reproducer or recorder of a phonograph whereby the same is fed transversely with respect to the direction of movement of the surface of the
15 record and the stylus traces upon the same a spiral path. In devices of this character it has been the usual practice heretofore to provide a feed screw cut with a very fine thread, such as 100 threads to the inch, and 20 to secure to the carriage a spring arm provided with a nut for engagement with said screw, thereby feeding the carriage forward a distance $.01^{\prime \prime}$ for each revolution of the feed screw. It has sometimes seemed de-
25 sirable to feed the carriage at a slower rate of speed than this, but for mechanical reasons the production and operation of a screw of finer pitch than that referred to is practically impossible. According to my
30 invention, however, I am able to obtain a very low rate of travel for the carriage, such, for example, as would be produced by a feed screw having 200 threads to the inch and operating in the manner described,
35 without, however, using a screw of any finer pitch than is now used, and in fact, if desired, the pitch of the feed serew may be increased very considerably and at the sime time the rate of feed decreased. This re-
10 sult is accomplished by substituting for the feed nut referred to, a rotatable serew or threaded wheel, the thread of which is the reverse of that of the feed serew and of a smaller inclination with resperet to a rertical 45 plane, as, for instance, when a whed of greater diamoter than the feed screw is Hireaded with the same pitch. Such a wheel when supported in frictiomal engagement with the feed serew will be robnted therely,
50 and on areonnt of the inclintion of the thrend of the feed serew being slighty greater than that of the wheol, the serew will exert a throst thereon mad will amse the same to travel at of rute which is cymat
threads, which depends upon the relative diameters of the tivo parts. For instance, if the wheel be of twice the diameter of the feed screw and both are threaded with a screw of .01 of an inch pitch, each revolution of the feed screw will feed the wheel forward only . 005 of an inch. As another example, if the diameter of the feed screw is $5 / 8^{\prime \prime}$ and its thread $1 / 16^{\prime \prime}$ pitch, and the diameter of the wheel $3 / 4^{\prime \prime}$ and pitch $1 / 16^{\prime \prime}$, each revolution of the feed screw will feed the wheel forward $1 / 96^{\prime \prime}$; or if the threads on these members are $1 / 32^{\prime \prime}$ pitch, the feed for each revolution will be $1 / 192^{\prime \prime}$. My invention may be properly termed a differential feed, because the forward movement is equal to the difference in the inclination of the threads and may be calculated (when both screws are of same pitch) by subtracting from the pitch of the feed screw the product of the pitch multiplied by a fraction whose numerator is the diameter of the feed screw and whose denominator is the diameter of the other screw.
Referring to the accompanying drawings, 80 Figure 1 is a front elevation of a phomograph provided with a feed device constructed in accordance with my invention: Fig. 2 is a section on line 2-2 of Fig. 1: Fig. 3 is a front elevation, largely in sec- 85 tion, of a modified structure: Fig. $t$ is a side elevation partly in sedion, of the devier of Fig. 3, and Fig. 5 is a front elevation of a second morlification.
Corresponding parts are designated by 90 the same reference mumerals in the sement views:
The phonograph shown is of the Edison type, and comprises the mismal borly 1 and carriage 2 which stiles upen the back rod :3. The mander $t$ is momond mpen the main shaft is which is provided with a feed simen (is su themded as to prothoe a forward mowement of the canviage ? when the matin shaft is rotuted in the proper diredion. 'This 100 ferd serew, as has heen explathend is ardi marily made of a pitch comal to . 11 ". This pitcli may la hisd if desibed. w: aspew of errater piteh may be misel, as before indi
 the semen is is a rotutulaly membteal whed or semer of granter diameder than the arow fo med the thread of whid is remered with
 For exmmple, if the seme 6 is a right hame 110
ed screw, then the thread of the screw $T$ is left handed. The wheel 7 is journaled in bearings formed in a yoke 8 , which is secured by screws ! to a spring arm 10 which 5 extends forward from and is secured \{o the carriage 2. Obriously the wheel 7 will be in tielding frictional engagement with the screw 6 , the engaging pressure being due to a portion of the weight of the carriage 2 , the proper pressure between the screw 6 and wheel 7. Preferably a semi-circular guard 11 partly encircles the wheel 7 said guard being carried by the joke 8 . It is not absolutely necessary that the pitch of the tro screws be the same because, for example, the screw 6 may be provided with a double thread, the pitch of each thread being, say, one fiftieth of an inch, the turns of one ead being of course, exactly midway be tween the turns of the other thread. In this case the pitch of the wheel 7 could be $.01^{\prime \prime}$. The thread upon the traveling wheel may consist of a single convolution 15 as shown in Fig. 5.

Instead of relying upon friction to cause rotation of the wheel 7 , the same may be positively driven by the feed screw as in the device of Figs. 3 and 4. Here the feed is milled longitudinally to form gear teeth 12 the depth of which is less than the depth of the thread of the screw. The wheel $7^{\prime}$ is a spur gear having teeth 13 extending continuously across the width thereof. A wire 14 is secured to the exterior of the gear $7^{\prime}$ in such a way as to form a spiral whose pitch is the same as that of the screw $6^{\prime}$ and whose direction is reverse. The teeth 13 are adapt40 ed to mesh with the teeth 12 , while the wire 14 engages the thread of the screw $6^{\prime}$ so that the gear $7^{\prime}$ is driven by the said screw.

While I have described my invention as applied to a phonograph for producing the
durng the progression of the carriage, said screws being of reverse thread and the diameter of the feed screw being less than that of the traveling screw, substantially as set forth.
2. A mechanical movement comprising a
longitudinally immovable feed screw, a movable carriage, and means for progressing said carriage along said feed screw, comprising a single screw mounted free to rotate and carried by the carriage with its thread constantly in mesh with that of said feed screw during the progression of the carriage, said screws being of reverse thread and of the same pitch, the diameter of the feed screw being less than that of the traveling screw, substantially as set forth.
3. A mechanical movement comprising a longitudinally immovable feed screw, a movable carriage, and means for progressing said carriage along said feed screw, comprising a single screw mounted free to rotate and carried by the carriage with its thread constantly in mesh with that of said feed screw during the progression of the carriage, said screws being of reverse thread. and the thread of the traveling screw being of smaller inclination than that of the feed screw, substantially as set forth.
4. A mechanical morement comprising a feed screw, a morable carriage, and means for progressing said carriage along said feed screw, comprising a screw mounted free to rotate and carried by the said carriage in constant yielding engagement with said feed screw during the progression of the carriage, said screws being of reverse thread, substantially as set forth.
5. A mechamcal movenent, comprising a feed screw, a movable carriage, a spring arm secured to said carriage, and means for progressing said carriage along said feed screw comprising a screw mounted free to rotate and secured to said arm and engaging said feed screw during the progression of the carriage, said scretrs being of reverse thread, substantially as set forth.
6. A mechanical movement, comprising a feed screw formed with radial teeth, and also with a screw thread, a movable carriage, and means for progressing said carriage along said feed screw with a differential movement, comprising a rotatable screw formed around its entire periphery with radial teeth and also with a screw thread. and carried by said carriage, the thread and teeth of said rotatable screw being in constant engagement with the thread and teeth of said feed screw during the progression of the carriage, and said screws being of reverse thread, substantially as set forth.
7. A mechanical morement comprising a feed screw formed with a helical thread and also with radial gear teeth of a depth less than that of the thread, a carriage movable axially of said screw, and a wheel carried by said carriage, said wheel formed with gear teeth and with a spiral convolution surrounding said teeth, of the same pitch as the thread of the screw, the thread and teeth of said screw being in engagement with the
convolution and teeth of said wheel, substantially as set forth.
8. In a phonograph, the combination with the sound box, a support for the same, and 5 the mandrel, of means for causing a relative shift of said sound box support and mandrel axial of said mandrel, comprising a feed screw rotatable with said mandrel and a threaded wheel mounted free to rotate and 10 carried by the sound box support, with its thread constantly in mesh with that of said feed screw, during relative movement in one direction between said support and said
screw, the diameter of said wheel being different from that of said screw, said mandrel and support being relatively shiftable members and one of said members being immorable longitudinally of said mandrel, substantially as set forth.
This specification signed and witnessed 20 this 21st day of December 1900.

> HERMAN WOLKE.

Witnesses:
Frani L. Dyer, Anna R. Klehim.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
R. A. BOSWELL.

AMPLIFYING HORN FOR TALKING MACHINES.
applioation filed may 11, 1910.
999,954.
Patented Aug. 8, 1911.


# UNITED STATES PATENT OFFICE. <br> ROBERT A. BOSWELL, OF WASHINGTON, DISTRICT OF COLUMBIA. 

## AMPLIFYING-HORN FOR TALKING-IIACHINES.

999,954.
Specification of Letters Patent. Patented Aug. 8, 1911.

Application filed May 11, 1910. Serial No. 560,562.

## To all whom it may concern:

Be it known that Robert A. Boswell, a citizen of the United States of America, residing at Washington, District of Columbia,
5 has invented a new and usefnl AmplifyingHorn for Talking-Machines, of which the following is a specification.

The invention about to be set forth and claimed belongs to the art of acoustics, and sound conveying tube having a compound curved tubular member arranged at a point between the free ends thereof, and adapted for use upon talking machines and the like.

The novel principle of this invention is to support the arm and horn in the compound curved tubular member, in order to have free movements, whereby the stylus of the sound box may accommodate itself to
20 the sound wares, or amular indentures of the record.

A further feature of the invention is to so connect and support the arm and the horn of this particular form as to allow the arm to dispose it slightly to one side thereof, or to raise the horn vertically. When the horn is raised, the same is casily and readily supporter within a portion of the compond also understond that the arm may be sum)porter in the member by friction. The hom, as shown in Figure 2, may be so arranged as to swing laterally, as well as vertically, but, as shown in Figure 1, the lateral movement of the hom is dispensed with.

In the exposition of this sperifieation, at particular desigu of machine is adhered to bat the invention is mot to be confined of thes special design. Its reduction to prace tice may require certain changes and alterations which the right is clamed to make. provided surb ehanges and atherations are compreluended by the apperaded dams.

The somud conteying tulo proper only consists of three parts, and so sumpmed als above stated, as $\mathbf{1 0}$ perform all how monsalry functions requited upon a talking machine.

Finther features and the armanement of pointed ont in the clatims.

Reforring to the dranvings,
Fignte I is a side clevation of " lalking machine, showing an moplifying homap. plied thereto, and provided will the com-
pound curved tubular member, for the support of the free moving parts of the horn.
Figure 2 is a vertical sectional view through the compound curved tubular member, which is shown in Figure 1, with the 60 exception that the members 29 and 30 are eliminated.
Fighre 3 is a sectional view on line 3-3 of Figure 2, disclosing the comection between the compound curved member and its 6 support.
Figure 4 is a detail sectional view, showing a portion of the compound curved tubular member, connected to its support by means of screws.

Figure 5 is a detail sectional view of a modified form of the mounting of cither the componnd curved member 6 or the curved member 21.

As to the drawings, 1 denotes the casing of 75 a talking machine, containing the usnal mechanisin (not shown) for rotating the table carrying the records.

2 represents a bracket secured to one side of the casing for supporting the amplifying hom 3.

The amplifying horn comprises the horn proper 4 and the reproducer arm $\bar{i}$. which are movably supported within the componad curved tubular' member (6. 'Thar tubulin' s5 member is detachably supported mpon the bateket 2 , as shown at $\overline{6}$. The compomme curved ubular member is provided wilh : projection 8, which has lateral projectioms ?, which, together with the projections s. form an approximately $T$-shapeed member. which is dove-tailed or recemed wilhin the recess 10 of the bataked 2. 'This rectos 10 conforms to the shaple of the T-shaped pros jection, and is designed to lit neatly and ? smogly therein, there not being sulliciont fris tion to prevent the ready removal of the satid T-shaped projedion.

In Vigure 1 , the componind amed tuble lar member, at its lower portion, is : heyhty 100 culargent, as shown at le, which is pmonder
 in ligume 1 is pemetratal lig a pair of sacews 1.1, which are theaderl inte the re resces 1:3, in wrder that the tulnhlar mombur tox may be readily mad dachably sulpermb "10in the bmak! !.

In ligare 1. the hom proper at it in
 neck 15, which is lelescoppusally reweind 110

## E. T. CONDON, JR.

ATTACHMENT FOR TALKING MACHINES,
APPLICATION FILED FEB. $2,1909$.
1,000,582.
Patented Aug. 15, 1911.


2Nitnesses:
EXA Leidall
5. 0.5 mathn.

## Edward Thowas Conden finventor 23.ighisattorney

# UNITED STATES PATENT OFFICE. 

EDWARD THOMAS CONDON, JR., OF MORRISTOWN, NEW JERSEY.
ATTACHIIENT FOR TALKING-MACHINES.
1,000,582.
Specification of Letters Patent. Patented Aug. 15, 1911.
Application filed February 2, 1909. Serial No. 475,686.

To all whom it may concern:
Be it known that I. Edward T. Condon, Jr., a citizen of the United States, and a resident of Morristorn, in the county of
5 Morris and State of New Jersey, have inrented certain new and useful Improrements in Attachments for Talking-Machines, of which the following is a specification.

My invention relates to attachments for 10 talking machines, and particularly to talking machines employing a rotating record disk.

It has for its object to automatically stop the rotation of the disk as well as to disenof the record has been reached; also, to provide extremely simple means to aceomplish this result and which may readily be attached to apparatns ahready in use, no

I am aware that varions attachments have been revised to antomatically stop the rotation of the disk, but so far as I am aware, all these derices throw the action upon the needle itself, or do not disengage the needle from the record or other surface. The diaphragm, which is a very delicate ard a most important part of the apparatus, is thas exposed to serions damage. and all more-
30 ments of the needle will be reproduced to the amoyance of the listencers. With my attachment, howerer, the needle is at once disengaged from the reoord disk as som as the end of the piece is reachecl. and the motion of the said record disk arrested. The attachment, also, is smiterl for any existing machine of the disk record type withont regrining the slightest change in same, and is readily removed if not required.

Thic nature of my invention will be best understenod in cominetion with the accompanying drawings in which -

Figne 1 is a han view showing my deviee alladied. Wig. 2 is a side elevation.
portion of said disk is placed a plate 12 preferably provided with a circumferential groore 13 so that the same may be readily: lifted off the disk 10 when removing the record. This plate is of sufficient sirface to allow it to be carried along with the disk 10 in its rotation. If there be not sufficient friction to accomplish this, the underside may be covered with felt or the like. A hole 1t is bored horizontally through this plate 12 as near the center as possible, and through the same passes an arm 15 slidably held therein. so as to be adjustable for varions sizes of record disks, and is thus firmly supported by the said plate. A handle if is provided to adjust the arm 15. It one end, the said arm is provided with a recessed stop consisting of a flexible guirle 17 and block $17^{\prime}$ forming with each other a suitable angle or broadly a recess so as to engage with a co-acting member on the reprorlucer, in this case the edge 18 of a locking plate 19. This edge is silitably bereled so that as contact is made between the stop and the plate 19, the latter is slightly raised. contact being first made at the bottom of the plate. An indicator gage 20 is carried hy the heard of the arm 15 to enable the recessed stop to be properly set with respect to the record. The relation between the parts is sucle that when the arm 1.5 is adjusted to bring the gage to the partimular line of the record at which it is desired that the playing should stop, then the reessied stop on saicl arm will also be in correet position to receive the member 19 on the reproducer, as some as the rotation of the record has lwonght the needle to the lime therens at which the gage has heen located as a foresaid.

The plate 19 is semed to the repmoducer 21. heing held against ifs mblare insulator 22: : and its hower erge is arranged to lo a slight distance alowe the point of the needle 2? so as not to make contad with the remerd disk 10 or indicator 20. As the alge is of plate 1!) slites iuto the stop. He plate 1! is Slighay raised as explamed, rasing the me-

 and lifting thereby the nemalde e:? free of the recored disk 10 amb alsa stopphing the pot: tion of satu disk. By making the :1rn 1 is
 to coibperente with the plate 1! an that the neade 2e: is diswhaged from the diak 10
at practically the conclusion of the piece and the morement of the disk arrested.

I claim :-

1. In a disk-record talking machine: a the record disk, and having a horizontal hole bored through the same; an arm passing slidably through said hole and supported by said plate; a stop at one end of said arm; and a locking member carried by the reproducer of said talking machine, adapted to lock in said stop when the needle has reached the end of the record and to disengage the needle from the said record disk.
2. In a disk-record talking machine: a plate adapted to fit over and be carried by the record disk, and having a horizontal hole bored through the same; an arm passing slidably through said hole and supported by said plate: a stop at one end of said arm; and a plate secured to the reproducer of said talking machine and haring its lower edge a slight distance abore the point of the needle, and being adapted to lock in said stop when the needle has reached the end of the record and to disengage the needle from the said record disk.
3. In a disk-record talking machine: a plate of large bearing surface adapted to fit orer and be carried by the record disk, and haring a horizontal hole bored through the same; an arm passing slidably through said hole and supported by said plate; a stop at one end of said arm; and a thin plate secured to the reproducer of said talking machine, haring its lower edge a slight distance abore the point of the needle, and being adapted to lock in said stop when the needle has reached the end of the record,
the angle of contact between an edge of said plate and the stop being such as to lift the reproducer slightly and thereby disengage the needle from the said record disk.
4. In combination with a disk-record talking machine having a pirotally supported reproducer,-a member carried by the center portion of the record-disk having a radially extensible arm prorided at its outer end with a stop consisting of a pair of vertically disposed members separated by a slight cleft, at least one of said members being flexible; and a rertically disposed plate carried by the reproducer, to enter edgewise and lock in the cleft of the stop to tilt the reproducer and its needle off the record and stop the rotation of the record.

万. In combination with a disk-record talking machine having a pivotally supported reproducer,-a member carried by the center portion of the record-disk haring a radially extensible arm provided at its outer end with a stop consisting of a pair of vertically disposed members separated by a slight cleft, at least one of said members being flexible; a vertically disposed plate carried by the reproducer, to enter edgewise and lock in the cleft of the stop to tilt the reproducer and its needle off the record and stop the rotation of the record ; and an indicator gage on said outer end of the extensible arm.
Signed at New York in the comnty of New York and State of New York this 1st day of February A. D. 1909.

EDWARD THOMAS CONDON, JR.
Witnesses:
Fredi. F. Schuetz, Sally O. Yudizity.

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100,401=
$$

J. C. ENGLISH.

SOUND BOX.
APPLICATION FILED FEB. $8,1910$.
1,001,746.
Patented Aug. 29, 1911. 2 SHEETS-SHEET 1.


WITNESSES
कrif:Fanturaw.
All. Gardner.

John C. English:

By

J. C. ENGLISH. SOUND BOX.
APPLICATION FILED FEB, $8,1910$.
1,001,746.
Patented Aug. 29, 1911.
2 SHEETS-SHEET 2.


# UNITED STATES PATENT OFFICE. 

## JOHN C. ENGLISH, OF CAMDEN, NEW JERSEY, ASSIGNOR TO VICTOR TALKING MACHINE COMPANY, A CORRORATION OF NEW JERSEY.

SOUND-BOX.
$1,001,746$.
Specification of Letters Patent. Patented Aug. 29, 1911.
Application filed February 8, 1910. Serial No. 542,745.

## To all whom it may concern:

Be it known that I. John C. English, a citizen of the United States, and a resident of the city of Camden, county of Camden,
5 State of सew Jersey, have invented certain new and nseful Improvements in SoundBoxes, of which the following is a full, clear, and exact disclosure, reference being had to the accompanying drawings, form10 ing a part of the following specification.

This invention relates to certain new and ussful improvements in sound boxes for talking machines, as will be fully described hereinafter and particularly pointed out in

In the accompanying drawings, Figure 1 is a front elevation of a sound box constructed in accordance with this invention; Fig. 2 a section of the same on line II-II of Fig. 1 looking in the directions of the arrows; Fig. 3 a bottom plan riew of the same. Fig. 4 is a front elevation of a modified form of sontid bos constructed in accordance with this invention; Fig. ts a sec-
phragm may be constructed of metal haying an inwardly turned peripheral cylindrical flange 9 adapted to fit snugly in the cylindrical wall 6 of the casing and to be frictionally retained fixed therein, the rear edge of the rim being in abutment with the inner flat surface of the casing. The diaphragm may also be provided with a series of concentric corrugations 10 .

To form a suitable smpport or mounting for a stylus bar 15 , a vibratory member 16 is provided, which is made of metal or any snitable material and preferably annular in shape, and of sulstantially the same external diameter as the diameter of the casing 1. The main portion of this vibratory member is preferably flat, and is prorided with a central aperture 17 of substantially the same diameter as the diameter of the central aperture 4 in the casing. and with a forwardly projecting marginal rim 18. The ribratory member 16 is comparatively rigid, and is secured to the casing 1 by means of a yiedding member 19 made of tempered spring stecl. or of any other snitable resilient material. The vielding member 19 is preferably in the form of a flat plate, and the rim is of the vibratory member 16 and the rim of the casing 1 are flattemed extomally: as at 20 , to form a suitable sont for the yielding member. Which is serared in place by means of serews 21 extending throngh the rielding member and theraded into the rime of the vibatory member and the rim of the casing respectively: The space 22 between the vilmatory wemher 16 and the easing 1 , is preferably very small and only suflicient to permit of the necessary vilmations of the vibutory menber. The vibratory member is thins annected to the rasing 1 by the vidding member 19, and is fres to bibnte with remed
 Horong the rickling member sulstantialt! parallel to dire diaphagen s mal in alime. ment with the space 2 ? latwern the viba: torv member and the videling member.
'The stym har lis mas be of mase sutuble

 conmextion of mometing. which mine or mas tow loe resilient and which is prefombly we
 member lif, wad anmetrionly opposite the jolding member 1! which comeds the vi-
bratory member to the casing. One form of mounting which may be used to connect the strlus bar 15 to the vibratory member 16. consists of a flat yielding plate or member 25 , made of tempered spring steel or any suitable material, which is secured at one end to the stylus bar in a slot provided therefor in the bar, and at its other end is secured in a slot in a rigid base plate 26 , member 16 br means of screws 27 , the space betreen the stylus bar and the base plate 26 is preferably only sufficient to permit of the necessary oscillation of the bar, and the bar 15 is thus mounted upon the yielding connection 25 to oscillate in a plane perpendicular to the diaphragm about an axis substantially fixed with respect to the vibratory member 16 and parallel to the axis of oscil20 lation of the vibratory member. The resilient connection 25 between the stylus bar and the vibratory member 16 is preferably made thinner and lighter, and consequently much more sensitive than the resilient connection 19 between the ribratory member 16 and the casing 1 of the sound box.

The stylus bar 15 is preferably made of any suitable resilient metal or material, and the inner portion of the stylus bar is tapered and turned ontwardly and then inwardly and downwardly in the form of a compound curve. and the inner end 28 of the bar is suitably connected to the central portion of the diaphragm. The main portion of the stylus bar extends radially with respect to the sound box and the outer end of the bar is provided with the usual strlus socket for receiving a stylus 29 which is held in position as usnal br a thumb screw 30 .

In the operation of this sound box, the ordinary sound oscillations of the stylus bar are transmitted to the diaphragm through the vielding of the resilient comnection 2.5 between the bar and the vibratory member 16, but any unusual shocks or jars are taken up by the yielding of the connection 19 between the vibratory member 16 and the sound box casing, and by the rielding of the curved inner portion of the strlus bar, and the effects of such shocks or jars on the diaphragm are thus minimized or softened, and practically eliminated. which prevents the defective qualities technically known as "blast" or "rattle " or "shatter" and other mpleasant qualities which are incident to the operation of some somed boxes under some conditions.

One of many modifications of this invention comprises as illustrated in Figs. 4 to 8 of the drawings a sound box consisting of an annular casing 40 having a formardly projecting peripheral rim 41 and a central aperture 42 which serves as usual, to conduct sound waves. Upon the rear face of the cas- ing 40 is secured, by means of screws 43 ,
a tubular extension 44, whereby the sound box may be connected to the usual sound convering tube. Telescoping suugly but morably within the rim 41 of the casing is an amnular ribratory member 45 , which is connected to the casing in any suitable manner to oscillate with respect thereto. The connection between the vibratory member 45 and the casing 40 may consist. as shown in the drawings, of two rearwardly projecting peripheral lugs 46 and 47 rigid with the vibratory member 45 and projecting in the recess provided therefor in the rim 41 of the casing and rotatably engaged against the inner surfaces of two lugs 48 and 49 respectively, which project outwardly from the rim 41 of the casing and are rigid therewith. Pivots 50 and 51 arranged in alinement. extend between the projections 46 and 48, and $4 \overline{6}$ and 49 of the vibratory member and the casing respectively, whereby the vibratory member is piroted to the casing upon a fixed axis. For lolding the vibratory member 45 yieldingly in a predetermined position upon its pirots with respect to the casing 40 , a pair of springs, 5 5 and 56 , are provided, one of which is secured at one end by a screw 57 to the lug 48 on the casing, a washer 58 being interposed between the spring and the lug. The other spring, 56 , is secured at one end to the lug 49 of the casing by means of a screw 39 a washer 60 being interposed between the spring and the lug. One of these springs, $\check{5}$, extends forwardly from the casing and engages a boss (6) arranged in front of the axis of oscillation of the vibratory member to upon the lug 46 rigid with the vibratory member and the other spring 56 . extends rearwardly from the casing and engages a boss 66 in the rear of the axis of oscillation of the vibratory member on the lug $4 \bar{r}$ rigid with the vibratory member. The springs, 55 and 56 . are normally held by their screws 57 and 59 . under a tension. and the outer ends of these springs, therefore, normally press upon the boss of the vibratory member and hold the vibratory member yieldingly moder a balanced tension in a predetermined position. A stylus bar io projects radially from the vibratory member 4,5 rigid therewith, and is provided with the usual socket for holding a stylus i1, which is secured in place by the usinal thumb screw 72 . The stylus bar may be arranged between and adjacent the pivots 50 and 51 . which form or determine the axis of oscilbation of the bar. as shown in Figs. 4 to 7 , or the bar might be arranged diametrically opposite to this position. as shown in Fig. s. or in any other suitable position with respect to the casing. A diaphragm 73, of any suitable construction. is momed within the vibratory member 45 . This diaphragm 73 my be of similar form and construction to that previously
described, the vibratory member 45 being provided with a suitable cylindrical bore 74 adapted to receive the diaphragm and to hold the flanged edge of the diaphragm in
5 a fixed position, and with an inwardly projecting rim 75 upon its inner edge to position the diaphragm. The central portion of the diaphragm 73 is yieldingly connected to the casing 40 by any suitable means, in this in-
10 stance, by a stiff rod 76 of steel or any other suitable rigid material, and a spider or bridge if of steel or brass or any other resilient material, which preferably consists of a central portion 78 and a plurality of
15 arms 79 radiating therefrom and spaced apart at equal angles. The rod 76 extends axially of the sound box from the diaphragm 73 rearwardly and at its outer end engages and is secured in any suitable man-
20 ner to the inner surface of the diaphragm at the center of the diaphragm. The inner end of the rod 76 is rigidly secured to the central portion 78 of the spider 77 . The spider it is preferably normally flat and so arranged in a planc perpendicular to the rod T6, and substantially in alinement with the rear surface of the casing 40 . The outer end of the arms $\tau 9$ are rigidly connected to the cylindrical wall of the opening t2 of
30 the casing, by solder or by any other suitable means. The dimensions of the spider: are such that it will flex or yield slightly under the maximun vibrations of the diaphragm but will be practically stationary and will not yield under any condition as readily as the anmular vibratory member 4, supporting the diaphragm. With this morlified construction in mind, it is evident that operation, its action will be shniar to the action of the form previonsly described. and ordinarily the central portion of the diaphragin will be hele substantially stationary with respece to the casing to by the stylns bar to escillates muler the aterion of a somed record, the vibatory ammar member 45 to which the rim of the diaphragn is fixed will be cansed to vibrate abont its pivots 50 and 51 , mater the restraining inflaence of the springs an and 5fo, and the dianphagm will thas be flexed betwem its bim and its central portion, and the somed waves will be tramsmitted thoongh the ontley at of the somed box. When, henverers, the
 jarss the spider or will yiold sulliciomels to
 as in the form lameinhe fore deseriberd.

It is olvions that tha spidor might ronsist of but (wo matial atols mbanged in alinemond (1) form a bridere ontonding diamotrically of the om, ming l: or tho spider might be of any olhere sultable embstruttion to form a yiekling sulp,ont fore the rod its.

Although only two forms in which this invention may lie emborlied have been illustrated, it is obvions that the invention might also be embodied in varions other forms without departing from the spirit of this invention, or the scope of the appended claims.
Maving thus fully described this invention. I claim and desire to protect by Letters Patent of the United States:

1. In a somnd hox. the combination with a casing. of a cliaphragm carried thereby: a vibratory member resiliently mounted on said casing, and a stylas bar monnted to oscillate upon said vibratory member, said bar being connected to said diaphragm by means of an ontwardly curved tapering resilient portion of said bar.
2. In a sound box. the combination with a casing, of a diaphagm carried thereby, a fixedly secured resilient member, a ribuatory menber momnted by means of said member to oscillate on said casing, a styhns bar and a fixedly secured resilient member commecting said bar and said vibatory member, said styhus bar being connected throngh a tapering ontwardly carved resilient portion to said diaphragm at a point between the axis of oscillation of said atylns: bar with respect to sald vibratory member, and the axis of oscillation of sad vibratory member.
3. In a sound box, the combination with :a casing. of a vibatory member mounted by means of a fixedly scolled reciliont member. to oscillate therecon, a diaphragm carred by said casing, and a stylus bar momed on said vibratory member by means of a secomed fixedly secured resilient member to escillate with respect thereto, salid tylus bar being comested to the central portion of atald diaphaggh, and the axis of wacilation of said Sibratory member with respect to said (asing and the axic of ocellation of said stybus bar with respect to saill vinatory member being "pon diametrically opposit. sides of the axis of said diaphagio.
4. In a smad bex. the combination with a casinge of a vilatary member, a fivally. secherd resilient rombertion betwern said masing and said vibuatory member. on - has


 saicl lan:
5. J. a somme low. the combination will al :asine, of a viluatory mamber. a livally.








a casing, of a corrugated diaphragm carried thereby, a vibratory member, a stylus bar, a fixedly secured resilient connection betrreen said ribratory member and said 5 casing, and a resilient connection between said stylus bar and said ribratory member, the said second-named resilient connection being less rigid than the first-named of said connections.
T. In a sound box, the combination with a casing, a concentrically corrugated diaphragm, a vibratory member, a resilient connection between said vibratory member and said casing, a stylus bar, and a resilient con15 nection betreen said stylns bar and said ribratory member.
S. In a sound box, the combination with a casing, of a concentrically corrngated diaphragm carried thereby, a vibratory member, a resilient connection between said ribratory member and said casing, a stylus bar comected to said diaphragm, and a resilient connection between said bar and said ribratory member, said bar connected to 25 said diaphragm through a tapering outwardly curved resilient portion of said bar.
6. The combination of a casing. with a stylus bar, an oscillatory mounting therefor, said mounting being resiliently secured to
30 said casing and a resilient comnection between said bar and said mounting. said connection being fixedly secured to each of said connected members.
7. In a sound box, a concentrically corrmgated vibratory sound producing member. means for supporting the same, means for supporting a reproducing stylus comected resiliently with said vibratory sound producing nember, and a member connected by
40 a fixedly secured resilient member to said means for supporting the vibratory member and upon which the means for supporting the reproducing stylus is resiliently mounted.
8. In a sound box the combination of a
recessed casing with a concentrically corrugated diaphragm mounted therein, an annular vibratory member mounted concentrically with saicl casing and having a central aperture therein, a fixedly secured resilient connection betreen said casing and said. member, a stylus bar mounted adjacent thie periphery of said member extending inwardly, through said aperture and remorably connected to said diaphragm, and a second fixedly secured resilient connection securing said stylus bar and said vibratory member to a point diametrically opposite said first-named connection.
9. In a sound box, a casing, a concentrically corrugated diaphragm carried thereby. a vibratory member resiliently secured at one side thereof to said casing and having a central aperture therein, and a stylus bar resiliently secured to said vibratory member at a point opposite to the connection between said ribratory member and said casing, said stylus bar extending through said aperture and secured to said diaphragm.
10. In a sound box, the combination of a casing, with a ribratory member, a resilient connection fixedly secured to said casing and said member, a stylus bar and a resilient connection fixedly secured to said member and said bar.

1t. In a sound box, the combination of a casing. with a vibratory member, a resilient comection fixedly secured to said casing and said member, a stylus bar and a resilient connection fixedly secured to said member and said bar, said last-mentioned connection be- 80 ing more flexible than the first-named.

In witness where of I have hereunto set my hand this th day of February, A. D. 1910.

## JOHN C. ENGLISH.

Witnesses:
Frank B. Middleton, Jr., Henry Robt. Kennedy.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
J. C. ENGLISH. SOUND BOX FOR TALEING MACHINES. APPLICATION FILED OOT. 27,1908
1,001,004.
Patented Aug. 22, 1911.
3 SHEETS-SHEET 1.

J. C. ENGLISH.

SOUND BOX FOR TALKING MACHINES.
APPLIOATION FILED OOT. 87, 1908.
1,001,004.
Patented Aug. 22, 1911.
3 8HEET8-8HEET 2.


Eig. 5.


Inventos
Johr C. CEvagrish.

## WITNESSES

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some: tant.
J. C. ENGLISH.

SOUND BOX FOR TALKING MACHINES.
APPLIOATION FILED OOT. 27, 1908.
1,001,004.
Patented Aug. 22, 1911.
3 sheets-sheet 3.


Frig. 8.


Fig. 0.


WITNESSES
947\%Hawner.
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Pardiner.
Tohn C. Einglishe.

# UNITED STATES PATENT OFFICE. 

# JOHN C. ENGLISH, OF CAMDEN, NEW JERSEY, ASSIGNOR TO VICTOR TALKING MACHINE COMPANY, A CORPORATION OF NEW JERSEY. 

## SOUND-BOX FOR TALKING-MACHINES.

$1,001,004$.

Specification of Letters Patent. Patented Aug. 22, 1911. Application filed October 27, 1908. Serial No. 459,713.

To all whom it may concern:
Be it known that I, Jorin C. English, a citizen of the United States, and a resident of the city of Camden, county of Cam-
5 den, and State of New Jersey, have invented certain new and useful Improvements in Sound-Boxes for Talking-Machines, of which the following is a full, clear, and exact disclosure, reference being had to the
10 accompanying drawings, forming a part of this specification.

The main objects of this invention are to provide an improved sound box having a stylus bar mounted to oscillate upon an axis endicular to the face of the bar is in operative position; to provide an improved sound box in which the diaphragm may be removed from the box without disconnecting the stylus bar from its
20 mounting; to provide an improved stylus bar and mounting therefor; and to provide other improvements as will appear hereinafter.

In the drawings, Figure 1 is a side eleva-
25 tion of a talking machine constructed in accordance with this invention; Fig. 2 a top plan view of the same with the amplifier slifted; Figg. 3 a front elevation of a sound box constrincted in accordance with this inFís, 5 a top plan vicus; and Fíre 6 a bottom phan view of the same partially in section on the line 6 - 6 of Fig. 3; Fig. 7 a modified form of the somm box of this in35 vention; Fiers. 8,9 and 10 are respectively a side elevation, a top plan view, and a bottom plan view partly in section, on line 10-10 of Fig. 7 , of the same.

Rofering to the drawings, the preferved
40 emborliment of this invention comprises the usuat cabinet or (asing 1, (alrying al sub) stantially horizontal record support 2 , rotated by the mstal meelanism within the casing for forn the reeord 3 , which is of the
45 disk type, havinge laterally moblating somud erooves of miform depth. Thes bracked I, rigid wifh the casing, the radial hollow tapreping sombl box arm 5, supported at one cond by the bracked t, to swing in at plane
50 parallel to fle face of the remod, and the Lubulan gonse meck $f$, pisoted mon mun axis parallel to the fince of the record to the fiee
end of the radial arm and communicating therewith, are of well-known construction.
The preferred form of sound box 10 , used 55 in this invention, and shown in Figs. 1 to 6 , comprises a casing of well-known construction, including a circular back plate 11 having the usual central circular aperture 12, and having a rearwardly extending cylindrical peripheral flange 13, the rear edge of which is provided with an outwardly extending flange 14. The cover 15 of the casing has a central aperture 16 , slightly greater in diameter than the central aperture 12 of the back plate. and is provided with a rearwardly extending peripheral flange 17, the rear portion of which telescopes over the back plate 11. and fits snugly in the recess formed between the flanges 13 and 14 of the back plate, being secured in position by means of screws 18 , which pass through the outwardly extending flange $1 t$ of the back plate and into the lear edige of the flange 17 of the cover. Secured to the rear face of the back of the box by means of the serews 19 is the usual yielding tubular extension 20. of rubber or other similar material, having a $1101-y e^{2} d i n g$ lining 21 , of brass or other similar metal, wherehy the somed box is telescopically comected over the outer curd of the tulmiar support. (i. In the sonnd box the nsinal diaphragun is is mounted betwern ammiar giskets: which aro held in position between the back mad cover of the casing. The dinphagm beine in a plane sulstantially perpendiontar to the face of the recond, and being smbetantially. midway between the fromt and immer surfinese of the easinge, thens fombere chambers 90 of smbstantially simitar fom and iqual as parity un eade side of the diaphasin.
The stylus har. Ass shown in ite opmation
 and as shown in detail in Figes, 3 lo fio romb priscs a subatantially matial riguil intor
 lower pertion of the fromt of the conce of the bex, being spaced sliwhty herefome. Integrat with the wगser and of this emti and portion is a slighty phating mationt nron :31. Which taper hiward!, and which axtancs in a heri\%ontal plane (1) a point ${ }^{2} 2$ spaced betwera the reeticul protion of the
bar and the center of the diaphragm, then curves away from the face of the box 33 to a point substantially opposite the center of the box, then curves toward the face of the 5 box, forming a loop projecting laterally beyoud the center of the box, and terminates adjacent the center of the diaphragm in a short stud $3 \pm$ integral with the bar extending axially of the box, and having an en-
10 larged inner end 35 , which is secured against the outer surface of the diaphragm by means of a screw 36 through the diaphragm, or in any other suitable manner. It has been found that the comparatively slender taper-
Is ing and curved construction of the arm 31 , comnecting the upper end of the stylus bar to the diaphragn gives better results in the reproduction of sound than would be obtained were the arm more nearly straight
20 and rigid. The lower end 37 of the rertical portion of the stylus bar is turned downwardly and laterally outward in an oblique direction, and is provided with the usual socket 38 for the reception of the stylus 39 ,
25 which is held in position by the thumb screw 40. For mounting the stylus bar, to oscillate upon a vertical axis perpendicular to the face of the record or record support, the rertical central portion of the bar 30 is provided with a pair of inwardly extending spaced lugs 41, which are positioned at the lower end and adjacent the upper end of the rertical portion of the bar respectively, the lower lug having a downwardly projecting their 42 . These lugs are provined upon alinement and in a plane normally substantially parallel to the face of the box, in each of which is secured one end of a yielding
40 a flat piece of tempered steel, but which may be made of any other yielding material, suclı as copper, or fabric of any sort. The ends of these yiclding comnections are brazed or
45 fastened in place by any suitable means. For comecting the stylus bar to the cover of the sound box, a rertical cleat or rib 45 is secured to the face of the corer by means of screws 46. This rib is of a length equal
50 to the distance from the lower end of the lower lug 41 of the stylus bar to the upper edge of the upper vielding comnection of the bar, and the cleat is provided mith longitudinal shots corresponding to and in aline-
55 ment with the slots of the bar respectively, to receive the inner ends of the spaced yielding connections which are rigidly secured in place. This cleat is substantially parallel to the rertical central portion 30 of the bar, of the lugs 41 upon the bar are in close proximity.

The modified form of somed box constructed in accordance with this invention, shown
65 in Figs. 7 to 10, is similar in construction to
that already described, but the stylus bar and its mounting are located upon the righthand side of the front of the box instead of upon the left-hand side, as in the form first described. In this modified form, the stylus bar is between the center of the diaphiagm and the vertical cleat 35 , upon which the bar is mounted, and the lower end 26 of the bar extends obliquely downward and toward the central rertical plane of the sound box, thus bringing the free end of the stylus approximately beneath the center of gravity of the box, whereas in the first form described, the free end of the stylus diverges away from the central rertical plane of the box, and is at a greater distance from the plane.

This improved sound box in either form shown is adapted to be used either with a disk or cylindrical record having a laterally undulating sound groore or ridge of uniform depth or leight, and in either case the box is mounted so that the axis of oscillation of the stylus is, at all times when the sound box is in its operative position, substantially perpendicular to the plane tangent to the face of the record at the point of contact of the stylus. The stylus bar is thus held at all times when in operation rigidly against being caused to oscillate on its axis by any pressure on the stylus perpendicular to the plane of the record at its point of contact, such, for instance, as would be caused by the weight of the sound box, but is permitted to respond readily to any lateral pressure.

By this construction of a talking machine, the false and umpleasant vibrations heretofore audible in the reproduction of sound are largely eliminated, and the reproduction is rendered with a very close approach to perfection.

Having thus describel my inveution, what I claim and desire to protect by Letters Patent of the United States is:

1. In a sound box, a casing having a back plate and a removable corer, and a stylus bar mounted on spaced flexible supports extending longitudinally of said bar, and carried by said corer.
2. In a sound box, a casing haring a back plate and a removable corer, a diaphragm between said plate and corer, an elongated cleat on said cover and a stylus bar mounted by means of spaced flexible supports on said cleat, said supports being disposed in alinement on said corer.
3. In a sound box, the combination with a casing laving a removable corer, an elongated cleat secured to said cover, of a stylus bar mounted by means of spaced Hexible supports on said cleat, said supports being disposed in a plane with the axis of said stylus bar.
4. In a sound box, the combination with a 130
stylus bar, of flexible supports therefor spaced in longitudinal alinement at one side thereof.
5. In a sound box, the combination with 5 a stylus bar, of flexible supports therefor spaced longitudinally thereof.
6. In a sound box, a stylus bar having an intermediate rigid longitudinal portion, and pliant supports for said bar spaced longi-
10 tudinally of said portion.
7. In a sound box, a diaphragm, a stylus bar having an intermediate rigid longitudinal portion, and pliant supports for said bar spaced longitudinally of said portion,
15 preventing oscillation of said bar in a plane parallel with said diaphragm, but permitting free vibration in a direction transverse thereto.
8. In a sound box, the combination with

20 a diaphragm, of a stylus bar having an intermediate rigid longitudinal portion, a yielding conmection between one end of said portion and said diaphragm, means for supporting a stylus at the other end of said
25 portion, and spaced pliant supports for said bar so arranged as to prevent pressure on said diaphragm due to the weight of said box.
9. In a sound box, the combination with a

30 diaphragm, of a stylus bar having an intermediate rigid longitudinal portion, a yielding conncetion between onc end of said portion and said diaphragm, means for supporting a stylus at the other end of satid portion, and flexible supports for said bar spaced longitudinally of said intermediate portion.
10. In a sound box, the combination with a diapluragm, of a styhus bar having au in-
40 termediate rigid longitudinal portion, a yielding connection between one end of said portion and said diaphragm, means for supporting a stylus at the other cud of said portion, and spring supports for said bar
45 spaced longitudinally of said intermediate portion.
11. In a somed box, the combination comprising a casing, a diaphragm, a single clongated cheat secmed to saisl casing, a
50 stylus har having ant intermediate rigid longitudinal portion, a tapering curved rosilient connerction between one end of sated portion and sadd diaphragm, means at the oflew end of said pertion for carring a
55 stylus, ame alined phiant means resiliently secmbing said har in satid deat, satel plant 1uman extonding from one side of said $\begin{aligned} & \text { anat }\end{aligned}$ to one side of said ban and mandaning sated hal sulb-tantially parallel will suid dia-
12. In somat prothecing mechanism, the combination wilh a masing, of means within said casing arranged to produco sombl, a stylus hat, plimut supports for sath hat con-
65 meded by means of 11 cleal pumallel them-
with and on one side thereof to said casing and extending in a plane with the axis of said bar. and an arm connecting said stylus bar and said sound producing means.
13. In sound reproducing mechanism. the 70 combination with a casing, of means within said casing arranged to reproduce sound, a stylus bar, spaced pliant supports on one side of said stylus bar detachably connected with said casing and adjustable in a plane parallel with said sound reproducing means, and an arm detachably connceting said bar and said sound reproducing means.
14. In sound reproducing mechanism, the combination with a sound box arranged to 80 be supported in coöperative relation with a sound record disk, of a diaphragm operatively mounted in said sound box, a stylus bar provided with flexible supporting means in ribratory relation with said box and arranged to be supported thereby to ribrate on an axis perpendicular to said sound record disk, and a stylus needle extending in oblique relation with respect to the axis of said stylus bar and arranged to operatively engage said sound record disk and vibrate said diaphragm.
15. In sound reproducing mechanism, the combination with a casing, of a diaphragm operatively mounted in said casing, a stylus bar having spaced flexible supports projecting from one side thercof, detachably engaged in rigid relation with said casing and having its axis of vibration perpendicularly disposed, a tapering resilient arme ex- 100 tending from said styhis bar to said dialphragm, and means arranged to detachably secure said arm to said diaphragm:
16. In sound reproducing mechanism the combination with a sound box arranged to be smpported in coüperative relation with actuating means, of means within said box arranged to produce somm, a styhis bato flexibly supported from one side thereof with respect to sad box and havine its axis of vibution substantially parallel with a perpendicular to sald actuating means, a detachably secmed commeetion bedwedn siald bar and the somed prodncine medranism in
 bar arranged to coöpperate with satid actmating means.
17. In a sombd box. Hac combination with a diaphracran, of a my has bare, plate dexible supports for satd bat secmeal to at chat or -danlatel on one side of suid bars, spaced
 stanlially patallel will and diaphagm. preventing presume on sad diaphagm ather than the nermal vibations.
15. In a somed hos. The comblimation with a diaphogm: of a s shas lan hav ine a rigid portion provided $1 \mathbf{1}$ ith an oblignely projed-
 alcon-ion, phate ilexible supports for said
$\qquad$

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bar secured to a cleat spaced apart and disposed in rertical alinement substantially parallel with said diaphragm and preventing the morement of said stylus bar relative 5 to said diaphragm other than its normal ribratory morement.

In witness whereof, I have hereunto set
my hand this 26th day of October, A. D., 1908.

JOHN C. ENGLISH.
Witnesses:
Alston B. Moclton, Alexander Parig.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

## F. W. SCHMIDT.

ATTACHMENT FOB TALEING MACHINES.


## F. W. SCHMIDT.

## ATTACHMENT FOR TALKING MACHINES.

APPLICATION FILED MAR. 8, 1911.
$1,001,171$.
Patented Aug. 22, 1911. 2 8HEETS-8HEET 2.


# UNITED STATES PATENT OFFICE. 

## FREDERICK W. SCHIMIDT, OF PHILADELPHIA, PENNSYLVANIA.

## ATTACHMENT FOR TALKING-MACHINES.

$1,001,1 \% 1$.
Specification of Letters Patent. Patented Aug. 22, 1911. Application filed March 8, 1911. Serial No. 613,028.

## To all whom it may concern:

Be it known that I, Fredericis W. Scimmot, a citizen of the United States, residing in the city and county of PhiladelState of Pennsylvania, have invented a new and useful Attachment for TalkingMachines, of which the following is a specificatior.
My invention consists of an improved atwhereby the machine is stopped when the stylus arrives at the end of the groove in the record.

It further consists of such apparatus may be attached to a talking machine without requiring records of special construction.
It further consists of other novel features of construction, all as will be hereinafter fully set forth.
For the purpose of illustrating my invention, I have shown in the accompanying drawings one form thereof which is at present preferred by me, since the same has been found in practice to give satisfactory and reliable results, althongh it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organizel and that my invention
30 is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Figure 1 represents a perspective view of as much of a talking machine as will illus-
35 trate the application of my invention to the same. Fig. 2 represents a diagrammatic plan view of the tone-tube, sommd-box, turntalhle and record of a talking machine, illustrating my improvement in phace and dia-
40 granmatically ilhstrating the electrical comections. Fig. 3 represents a perspective view of the slotted finder har of my attac. 1 ment. Fig. 4 represents a perspective view of the brake bex. Fige. is represents a plan conresponding parts in the figmess.

Referting to the danwings, (he numeral I indicates thee conbinet of a talking machines, indicates the cabinet of a talking madhme,
nopon the top of which is the remod cartiol view of the make-mechamism. Fig. (G represents an axial section of the brake-eylinder, brake-hlock and contacts. Fig. 7 represents a vertieal section of the posit upon which the slotted bar is adjustably seemed.
Similar mumerals of reference entivate or turntuble, $\Omega$, marying the recort, 3. A
bracket, 4 , projects upward from one side of the cabinet and carries the tapering tonctube, 5 , and the horn-elbow, 6. A soundbox, 7 , is supported at the free end of the tone tube, and suitably carries the stylus or needle, 8. All of these parts are of the usial or of any suitable construction, such as found in the well-known forms of talking machines.

A hollow post, 9, is secured upon the top of the cabinet, and a split plug, 10, haring a shouldered head, 11, fits in the bore of said post. A clamping thumb-screw, 12, is threaded into the top of the head of the plug, and serves to clamp a flat finder bar, 13, having a longitudinal slot, 14, with which it is movable upon the shank of the screw. Near its free end, this flat bar carries a stud, 15 , through which passes a contact screw, 16. The onter end of the flat bar projects laterally, in L-shape, and a liead, 17 , is provided at the extreme of the $L$, and has a needle, 18 , secured in it by a setscrew, 19.

A base-plate, 20, is secured upon the top of the cabinet and to one side of the turntable, and has, al cover, 21, forming a rectangular brake-box. A brake-cylinder or casing. 22, is secured upon said base-plate and in electrical contact with the same, and a plunger, 23 , fits to slide within it and has a pin, 24, projecting throngh a slot, in, in the upper side of the hrake cylinder, and a laterally projecting tooth, af, whicl projects throngh a longitudimal slot in the side of the celinder. A brake-phog. $\because t$, of leather. fiber, or other suitable material, tits in a socket in the emed of the piston, to ellgrage the rim of the turntahle to stop its rotation when the piston is formed ont ward by a coiled spring, 2 , within the hore of the cylinder and bearing matust the pistom. 'The opposite and of the hruke-eylimber is closed by a plug, e?, which conlimes the spring and a flanged sleenco 30, of insulating natertial fits in an axial bent in satid phin. 1 pin, 31 , fits in the bore of this sleere mal hats a contactpont, 32, !pon its immer and
 homed pin, 34. has phay in an a sial lowere 35, 105 int the lamise-pintom, and is hedrd from slip ping ond at doe immer end of smid bome las tha latter huring at contracted inner (oul.
 its cold which reginters wilh mad is opposend
to the contact-point of the stationary pin, and a spring. 37 , serves to force the head of the morable pin against the contracted end of the bore. The laterally projecting 5 tooth upon the brake-piston will engage a detent-notch, 38 , in the armature, 39 , of elec-tro-magnets, $39^{\times}$, when the brake-piston is moved inward. The corer for the brakemechanism has an opening, 40. in its side, othrough which the end of the brake-piston and its pling may project, and a slot. 41 , in its top, through which the upright pin upon the brake-piston projects and in which it slides. The end of this pin is engaged by a 15 slot in the end of a thmmb-lerer. 42 , piroted upon the cover, and by means of which lever the brake may be set.

One terminal, 43, of a battery, 44, is connected to the head of the stationary contact
20 pin in the brake-cylinder, and the other terminal, 47, is connected to the tone-tube of the talking machine. The slotted bar and its post is connected by a wire, 45 , to one terminal, 46 , of the magnet windings, the other terminal is oromed, at 48, to the base-plate of the brake-mechanism and thus to the brake-cylinder and piston.

In practice, the slotted finder bar is adjusted by means of the clamp-screw to bring
30 the pin abore the blank central space of the record. When a record is placed on the turn-table, the finder bar is moved laterally until the needle at the end of the bar can engage the end of the last groove upon the mhen depressed. the needle being nor mally out of contact with the record. As now the sound-box and tone-tube are mored inmard by the needle following the spiral groove in the record, the sound-box will at uponse contact with the contact screvw of the groove. This will close the circuit through the tone-tube and slotted arm, causing the circuit to pass from the battery, sound-box, through the contact-screm and slotted arm and the mire 45 to the electromagnets. As the brake-piston and plug hare been retracted into the cylinder by means of the thimb-lever, the stationary and yielding contacts are in contact, so that the current passes through the magnet windings. through the base-plate, through the brakecylinder, piston and contacts and back to the
55 battery through the insulated stationary contact and wire. 43. The magnets are thus energized and attract their armature, releasing the hrake-piston which flies out and engages and stops the tmontable, while, at the
60 same time. the circuit is broken, even though the sound-bos and the contact screw remain in contact. The rielding contact in the brake-cylinder admits of the points remaining in contact and the cnrrent remaining
forward, thereby preventing the armature from being released until after the tooth on the brake-piston has fully cleared the de-tent-notch in the armature.

By the employment of this device, a talk-
ing machine may be promptly stopped at the end of the piece it is playing, thereby preventing the hoarse and rattling sound of the needle traveling orer the blank portion of the record and saving the record, without obliging the operator to watch the machine and stopping it at the end of the piece,--the action here being entirely automatic. The distance between the pointer needle and the contact screw upon the slotted arm equals that between the point of the needle on the sound-box and the point where the latter contacts with the contact screw, so that the machine may be stopped with great accuracy if the pointer needle has been set orer the end of the last turn of the spiral groove in the record before the machine is started. The contact-screw may be adjusted to adapt it to make contact with different styles of sound-boxes at the proper point. After the bar has once been adjusted by means of the slot and the clamping screw, according to the size of the machine to which it is applied, and after the contact-screw has been adjusted, there will be no need for further adjustments of the bar, and all that is necessary to do when a record is changed is to bring the needle in register with the end of the groore by swinging the arm across the record until, by depressing the end of the bar, the needle strikes such groove.

While a brake for the turntable has been illustrated and described it is evident that any suitable stopping device for the machine may be substituted.

Having thus described my inrention, what I claim as new and desire to secure by Letters Patent, is:-

1. In an electrical brake for a talking machine, an adjustable finder bar carrying a contact device adapted to predetermine the actuation of the brake at the close of the reproduction automatically upon positioning of said finder bar, a sound-box arm and an electric circuit connecting said contact device and sound box arm.
2. In an electric brake for a talking machine, a normally open electric circuit haring one terminal connected to the sound-box of a talking machine, a finder bar piroted at one end upon a fixed portion of the machine to swing across the record and having at its free end a dornmardly-pointing neerle which may engage the record when the bar is depressed and a contact at a distance from the point of said needle equal to the distance from the point of the stylus of the sound-box to the point of the latter where it will engage such contact, said bar being connected to the other terminal of the cir-
cuit, and an electrically actuated brake device in the circuits for stopping the machine.
3. In an electric brake for a talking ma5 chine, a normally open electric circuit haring one terminal connected to the soundbox of a talking machine, a finder bar pivoted at one end upon a fixed portion of the machine to swing across the record and hav-
10 ing at its free end a downwardly-pointing needle adapted to engage the groove in the record when the arm is depressed, said bar being connected to the other terminal of the circuit, a contact-srrew in said bar and
15 adjustable to bring its point to a distance from the point of the needle equal to that between the point of the stylus in the soundbox and the point of the latter where it engages the contact-screw, and an electrically 20 actuated brake-device in the circuit for stopping the machine.
4. In an electric brake for a talking ma-
chine, a normally open electric circuit having one terminal connected to the sourdbox of a talking machine, a bar pivoted at one end upon a fixed portion of the machine to swing across the record and having at its free end a downwardly-pointing meedle which may engage the record when the bar is depressed and a contact at a distance from the point of said needle equal to the distance from the point of the stylus of the sound-box to the point of the latter where it will engage such contact, said bar being connected to the other terminal of the circuit and having means for adjusting it longitudinally and for securing it in its ad-
justment, and an electrically actuated brakedevice in the circuit for stopping the machine.

FREDERICK W. SCIIMIDT.
Witnesses:
War. Caner Wiederselm,
C. D. McVay.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
J. LOUVER.

DEVICE FOR AUTOMATICALLY STOPPING THE DISKS OF TALKING MACHINES.
APPLIOATION FILED MAR. 18, 1910.
1,001,418.
Patented Aug. 22, 1911.
3 SHEETS-SHEET 1.


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M. Wrong. a. M. nev.
J. LOUVER.

DEVICE FOR AUTOMATICALLY STOPPING THE DISKS OF TALKING MACHINES.
APPLICATION FILED MAR, 18, 1910 .
1,001,418.

Fog. 2


Witnesses:
H. H2 Dang z. Gurice.


## J. LOUVET.

device for adtomatically stopping the disks of talking machines.
APPLIOATION FILED MAR. 18, 1910.
1,001,418. Fiọ. 5
Patented Aug. 22, 1911. 3 sheets-sheet 3.


Fig. 8


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o. Crite.

Shevento
By Lunet Bonever
attorney

# UNITED STATES PATENT OFFICE. 

JULES LOUVET, OF INONTROUGE, FRANCE.

## DEVICE FOR AUTOMATICALIY STOPPING THE DISKS OF TALKING-MACHINES.

$1,001,418$.<br>Specification of Letters Patent. Patented Auc. '2.き, 1911. Application filed March 18, 1910. Serial No. 550,190.

## To all whom it may concern:

Be it known that I, Jules Louvet, of Montronge, Seine, France, have invented a Device for Antomatically Stopping the 5 Disks of Talking-Machines, of which the following is a specification.

This invention relates to the automatic stopping of the disks of talking machines provided with a needle or a sapphire when
10 the performance is finisherl, this stopping arrangement being applicable in cases where the disks employed bear a record begiming near the center and finishing near the circumference. With this object, the record is
15 extended by a curved or straight groove or embossment which causes the necille or the sapphire to move outside of the disk; the sound arm then falls on to a rod and its weight actuates a brake which stops the disk.

Figures 1 to 9 illustrate two different forms of the device employed. Fig. 1 is a plan of a talking machine provided with the antomatic stopping derice. Fig. 2 is a plan
25 of the stopping apparatus. Fig. 3 a side view of the same. Fig. 4 an ent clevation. Figs. 5to 9 illustrate a modified form of the device. Fig. 5 is a plan of a machine provided with a stopping device; Fig. ${ }^{6}$ is a 30 side view of the brake mechanism; Fig. 7 a plan of the same: Figs. 8 and 9 being respectively an elevation and aplan of a different form of the brake.

For the purpose of insuring the automatic 35 stopping of the apparatus, the disk a bearing the record has, following the record. a cirved or straight groove or cmbosment $b$. along which the nectle or the sapphire, carried by the diaphragin $c$ arranged on the 10 somnd arm d that pivots at $e$ in the nismal mather, must move.

In the device as shown in Figs. I to 1 stopping is offocded ly mommationlly ardmating the hamb-operated etap cmployed in eer-
45 tain machines. This stoppage by hand was coflected by a small roed i fomished with a button that is pressed by the finger. On this mond a pin! is fixel un which another pin /1 implinges which is momuted on the reculat (o) or gevermer and mates therewith. Tha somblation having (ampleted its (rand. that is to say finishom the mpropluction of How piowe is liod by the sapplive in the lat spian of the remend while flee disk am fimestaretate matil the spring is completely relased.

The automatic stopping according to the invention is effected as follows: I rod $i$ terminating in the form of a $T$ and held in position by a pedestal $j$ haring a socket, receives the sound arm d when the piece is finished, the arm $d$ being moved outside by the disk ". under the action of the curve b that runs to the outer rim of the disk and along which the sapphire or the needle monst move at the end of the record. The sound arm drops on to the $T$ part of the red $i$ and by its weight lowers that rod. This latter excrises pressure on another rod $\%$ terminating in an angular piece which actuates a lever $l$. To this lever a small connecting rol m is attached which terminates on the one hand in a pivot and on the other hand is connected with the rod $f$ and imparts thereto the motion for effecting the stopping, similar to that which would have been imparted with the finger. The lever $m$ is flexibly connected and fixed at $n$ on a support o which likenise supports the lever 7 . To one of the ends of the comecting rod a spring $p$ is attached which is pat mader tension by a serew $q$ held by a support $r$ and insure the starting of the apparatns. The regulating of the throw of the lever $l$ is offected be a small serew s moment on the 8 lever li:

In the eimplified device shown in Figs. 5 to $t$ the batace action is efleeted on the onter rim of the disk-earrying table $t$. In these figures the hrake is representerl as in contact with the disk earringe table. 'The deviec comprises a pedestal $j$. fummed with a sencled in which the rod $;$ is mgaged the "ppere cand or head of which is in the form of : Taml reedives the sommel arme at the re(fnimed moment. Tha lower part of this row ; rests on an sutall lever "pixoting at aco the

 "nntitnting the hake. I spming ! Pmishe





 giner is eflowterl thromgh the ficetion of the hanke ont the betcont of the diak-ameng table 1. The pede-hal j formed with a ancher
carries the rod $i$ as in the device described above. This rod $i$ bears, at the required moment, on a lever $y$ carrying a brake shoe $z$ which acts on the under surface of the table
$5 t$. The part of the lever $y$ where the brake shoe $z$ is placed forms a counterweight and faises the rod $i$ while the apparatus is in action.

## What I claim is:

10 In a talking machine the combination with a rotatable disk-carrying table, a record disk carried thereby, a sound arm, and a needle carried by the latter, of a brake device comprising an arm adapted to be
brought into contact with the table, and a 15 second arm arranged to support the sound arm when the latter has been moved laterally to cause the needle to be moved off of the record disk, said second arm being operated by the weight of the sound arm to effect the 20 operation of the first arm and stop the rotation of the table and disk.

In testimony whereof I affix my signature in presence of two witnesses.

JULES LOUVET.
Witnesses:
Dean B. Mason,
Victor Matrase.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

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1,006492
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## R. E. WILLIAMS.

GRAMOPHONE STOP.
APPLIOATION FILED MAR. $3,1911$.
$1,001,493$.
Patented Aug. 22, 1911.


## R. E. WILLIAMS.

GRAMOPHONE STOP. APPLICATION FILED MAB. 3,1911 .
$1,001,493$.

Patented Aug. 22, 1911.
2 SHEETS-SHEET 2.

attest: W. E. Helictur. M. C. Hammer


# UNITED STATES PATENT OFFICE. 

RALPH E. WILLIAMS, OF ST, LOUIS, MISSOURI.
GRAMOPHONE-STOP.
$\mathbf{1 , 0 0 1 , 4 9 3 .}$
Specification of Letters Patent. Patented Aug. 2:, 1911. Application filed March 3, 1911. Serial No. 611.987 .

## To all whom it may concern:

Be it known that I, Raliph E. Wimliams, a citizen of the United States, residing at St. Lonis, in the State of Missouri, have in-
5 vented certain new and useful Improvements in Gramophone-Stops, of which the following is a specification.

This invention relates to gramophonc stops, and has for its primary object to pro-
10 vide an improved construction, combination and arrangement of parts in devices of this character whereby it may be adapted for use with different sized records; made very delicate in operation, and by means of
15 which it may be readily adjusted to effect the braking action when the sound box has reached a certain point more or less distant from the center of the disk.

Other and further objects will appear in
20 the specification, and be specifically pointer out in the appended claims, reference being had to the accompanying drawings exemplifying the invention, and in which-

Figure 1 is a plan view of a gramophone 25 provided with my improved braking device. Fig. 2 is partial side elevation of the same. partly broken away, and parts being shown in section. Fig. 3 is a section on the line III-III, Fig. 2, showing the brake-operat-
30 ing mechanism in operative position. Fig. 4 is a section on the line IV-IV, Fig. 2. Fig. © is a fragmentary section through the axis of the turn table having a disk record momented thereon. Fig. 6 is a section on the
35 line VI-VI, Fig. 1.
The present invention contemplates the provision of improved means for antomatically stopping a disk gramophone at the emd of a selection, said means being adjustable
10 to adapt it for "1ec with records which end at different distances from the center and aceording to which a trip adjustment devier is mompted adjacent the center of the disk which is operable mader very delicate press-
15 sure from a part moving with the somd box, the brake being applied independently of the somme box and at the rim of the dick where it is most aflicient. In carpengent these purposes of the invention, the adjustable trip comprises a durable bul very deli(al aly momenter trip) hever whids is weighted (1) (lirow it into posif(on (o) cmpage a hrakereleasing lover nom as som which mormally. mantmins the trip lever in imperative posi-
moved into release position. Furthermore, my inproved automatic stop can be attached without alterations to ahmest any of the gramophones on the market and may be app- 6 plied to all the other machines by the provision of a ferv additional attachments, depending on the make and style of the machine.
Referring more particularly to the draw- 6.5 ings, the turntable 1 of the gramoplone has mounted theren a disk record 2 which is retained in position by a center plate 3 provided above with an integral knob or handle 4 by means of which it may be lifted. Said center plate and knob are provided with a center bore 5 adapting it to fit over the reduced end portion 6 of the gramophone spindle 7 , a clamping spring 8 being secured to the inner wall of the bore is by a screw 9. Projecting from the center plate 3 is a radial arm 10 provided with an upwardly deflected portion 11 which provides a perlestal or support for a tripping lever 12. said tripping lever 12 being provided with a recess forming a shoulder 13 which is normally engaged by a release lever 14 whose outer end is provided with an upwardly profecting support 15 throngh a perforation in which extends a rod or pin 16. The immer end of the pin 16 is sulp) ported by an eyelet 17 or wher smitable means carried by the release lewe 1t. Sad release lever $1+$ swings about a pivot 18 and has its movement limited hy a stop pin 19 in the path of movement of a projedion ? 0 formed ous said release lever. Is shown hest, in Fig. 1 of the dranwinge, the trip lever 13 has one and deflected mal provided on the extremity of that end with an chlarged portion or weight 21 which, whell the weloase lever 1.4 is moved haterally in the manner to be hereinafler sed ford permits the trip ferer $1: 3$ to assme the position shown in Fige. is in which its othere ched wen in the form 1 an of "f finger is alowned to a position in which it will enguge the immer and of a brakeoperating howe as. Salld bake operating leme 23 is pooved with In downwadly projedting prition 21 will a defleded fint 25 pivatally momblat. in the preand ambati


 an upwardy projecting linger hold ?! mul pandead oin its ontor swinging whe "ith " hook or com 30 which is mapled to aliblaly
engage a cam pin 31 projecting downwardly from the slide bar 32 of a resiliently mounted brake pawl. Said brake pawl is adapted to impinge the periphery of the turntable 1 by having a pad 33 of rubber or other suitable material mounted in an enlarged socket head $3 t$ which slides within a housing 35 which is radially secured to the base plate 26 by a screw 36 which projects into a de0 pending portion 37 of said housing 35. A spring 38 serves to resiliently press the brake pawl against the turn-table 1.

In Fig. 1 of the drawings, a swingingly mounted sound tube 39 of well known construction is illustrated, provided on its outer end with a sound box 40 . Depending from the sound box 40 is the usual needle 42 which travels over the record and sooner or later engages the pin 16 carried by the release lever 14, said pin 16 being constructed of any desired length corresponding to the range of diameters in the record disks.

The operation of my device will now be understood, and briefly stated is as follows: 25 The pin 16 haring been adjusted to bring its outer extremity adjacent the innermost record groore of the disk 2, the machine may be set in motion and left to run its course, the sound box needle 42 at the end of the record being brought into engagement with the pin 16 and serving to displace the release lever 14 by that means. When the release lever 14 is displaced laterally, the weight 21 forces the trip lever 12 into operative position in which the finger 22 thereon will be brought into engagement with the brake-operating lever 23 causing said lever to be displaced into the position shown in dotted lines in Fig. 1. By this movement of the brake-operating lever, a pin 43 which projects downwardly from the foot 25 of the brake-operating lever, is brought into engagement with the cam lever 28 causing said lever 28 to be displaced laterally to release the hook 30 from the pin 31 on the brake pawl and permitting the spring 38 to force brake pad 33 against the periphery of the turn-table.

What I claim is: ment out of engagement with the turn-table, and means operatably connected with the last said means for cailsing the release of the braking element and comprising a member adjacent the center of the turn-table and rerolving therewith, said member being normally in an inoperative position, and means for moving said member into operative position.
2. In a derice of the character described, 65 the combination with a turntable, a sound
box and a stop for engaging said turntable, of a lever overhanging said turntable, means carried by said turntable adjacent its axis for operating said lever, said means being movable into and out of operative position, and other means operatively related to the sound box for holding the first said means in inoperatire position, said other means being displaced by a member carried by the sound box when said member has reached a predetermined position.
3. In a derice of the character described, the combination with a turn-table and a sound box provided with a needle morable across said turn-table, of a resiliently mounted braking element operatively related to the periphery of said turn-table, a lever for holding said bralking element out of engagement with said turn-table, another lerer operatably engaging the former lever. a disk retaining member at the center of said turntable, and means carried bỳ said retaining member for operatably engaging the second lever, said means comprising a trip lever. and means for holding said trip lever out of operative position, the last said means being adjustable radially to engage the sound box ueedle at different distances from the axis of the turn-table.
4. In a derice of the character described, the combination with a turn-table and a sound box movable thereacross and provided with a tracing needle, of a braking derice disposed adjacent the periphery of said turntable and having an operating lever projecting across the face of said turn-table, a center piece for holding a disk in place on said turn-table, a trip lever pivotally mounted on said center piece, said trip lever being provided with means tending to hold it in position to engage said operating lever, a stop lever movable into and out of engagement with said trip lever, and means carried by said stop lever for operatively engaging the sound box needle.

5 . In a device of the character described, the combination with a turn-table and a sound box movable thereacross and provided with a tracing needle. of a braking derice disposed adjacent the periphery of said turn-table and having an operating lever projecting across the face of said turn-table, a center piece for holding a disk in place on said turn-table, a trip lerer pirotally mounted on said center piece, said trip lever being prorided with means tending to hold it in position to engage said operating lever, a stop lever morable into and out of engagement with said trip lever, and means carried by said stop lever for operatively engaging the sound box needle, said means being adjustable toward and away from the center of said turn-table.
6. In a device of the character described, the combination with a turn-table and a
sound box suitably supported to move across a record disk carried by said turn-table, said sound box being provided with a tracing needle, of a resiliently mounted brake ele5 ment for engaging the periphery of the turn-table, a cam lever for holding said braking element out of engagement with the turn-table, an operating lever adapted to move said cam lever out of engagement the braking element, said operating lever being disposed across the face of said turn-table, a disk-retaining center piece rotatable with said turn-table, a trip lever carried by said center piece, said trip lever being weighted to normally hold it in a position for engaging said operating lever, a stop lever normally holding said tripping lever out of operative position, and a pin carried by said stop lever and adapted to said sound box being provided with a tracing needle, of a resiliently mounted brake element for engaging the periphery of the turn-table, a cam lever for holding said braking element out of engagement with the
turn-table, an operating lever adapted to 30 move said cam lever out of engagement with the braking element, said operating lever being disposed across the face of said turntable, a disk retaining center piece rotatable with said turn-table, a trip lever carried by said center piece, said trip lerer being weighted to normally hold it in a position for engaging said operating lever. a stop lever normally holding said tripping lever out of operative position, and a pin carried by said stop lever, said pin being slidably mounted to adapt it to engage the sound box needle at different distances from the center.
8. In a device of the character described, the combination with a turn-table, and a braking device having a member supported adjacent the periphery of, and overhanging, said turntable, of a sound box provided with a tracing necdle and means rerolving with said turn-table for operating said member, said means being provided with an element adjustable to and from the center of the turn-table to intercept the tracing needle at any desired distance from the center.

> RALPH E. WILLIAMS.

In the presence of -
J. B. Megown,
M. C. Hamion.

Sopies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

## R. FORREST.

SOUND RECORDING AND REPRODUCING INSTRUMENT. APPLIOATION FILED DEO. 3, 1910.
1,001,748.
Patented Aug. 29, 1911.


# UNITED STATES PATENT OFFICE. 

## ROLIAND FORREST, OF PHILADELPHIA, PENNSYLVANIA.

SOUND RECORDING AND REPRODUCING INSTRUINENT.
1,001,748.
Specification of Letters Patent. Patenterl Aug. 29, 1911. Application filed December 3, 1910. Serial No. 595,531.

## To all whom it may concern:

Be it known that I, Rolland Forrest, a citizen of the United States, residing at Philadelphia. in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Sound Recording and Reproducing Instrument, of which the following is a specification.

This invention relates to somed recording 15 and reproducing instruments.

The objects of the invention are to improve and simplify the construction of such devices as well as to increase their efficiency in operation and to reduce the expense at-

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in 5) which is himed at its lowere oud as indicated at $f$, and is provided at its upprereme with a handle 7. satid doon beringe locked in chosed position in any suitable manmer, sum
50 as by means of the spring eately on atchese 8. Nommed in cach of the reed ehambers es and 3 is a stud shal lt ! which is adspted to receive a reel 10 . A riblem remod. comstructer in any suitable mammer, and indi-
to be wound back and forth first onto one reel and then onto the other reel. The ribbon 11 extends through the intermerliate chamber 4 and through cut-away portions 12-12 formed in the circular walls of the front and rear reel chambers 2 and 3 . The front and rear reels are adapted to be set in motion in any suitable manner such as by means of clock work or other well known automatic mechanism, not necessary herein to be specifically illustrated and described.
The ribbon 11 on its passage throngh the iutermediate chamber 4 extends orer and is guided by a support 14 which is formed preferably of hard rubber and is adjustably supported by means of a standard 15 which extends through a horizontal partition 16 mounted in the intermediate chamber 4 and is provided above and below said partition 16 with lock nuts or other suitable devices 17 by means of which the support $1+$ may be vertically adjusted. The ribbon 11, above the support 14 , is engaged by a needle 18 which may be adapted either for recording or reproducing, said needle being connected with a diaphragm 19 in a somd chamber 20 which commmicates through a pipe 21 with the horn 22.
The ribbon 11 is provided in any suitable and well known manner with somid records extending in opposite directions. The needle 18. as shown in Fig. 2, is laterally adjustable togetleer with the somed chamber on). in a slot 22 which extends from side to side of the upper end of the intermediate chamber 4. $\lambda$ fter the teend riblon has been mom to one end. the needle 18 is adjusted laterally. in the shot 22: and the movement of the rilibon is wevers. The introduction and removal of the rests 10 contamine the rithbon 11, and the adjustment of the suppent 11 are efleced her opening the dower a.
The instrame of the present invention is strong, simple. durable and ine epensive in comstruction as well as eflicicm in operation.

What is chamed as new is:
I somud recorder and reppodmore wom prising ar rasing having front and rear real chamberss and all intermediate chamher. sald red dhmbers beine dirmbar in aross sedelon and said intermediater chamber beener porided with 1 h horizontal partition and haviner of transemas shat at ite घमper omb formed with beveled side walls, 11 deme ehnsing therends of said chambers. 11 pair of terds. one of said reels bering momeded in the frome
reel chamber, and the other of said reels being mounted in the rear reel chamber. a ribbon record extending from one of said reels to the other, through said intermediate
5 chamber, there being openings in the walls of said reel chambers to permit the passage of said ribbon. a standard adjustably mounted in the horizontal partition of said intermediate chamber, a hard rubber support carried by the upper end of said standard, and a needle provided with downwardly
tapering supporting means adjustable in said transverse slot at the upper end of said intermediate chamber.

In testimony that I claim the foregoing as 15 my own. I have hereto affixed my signature in the presence of tro witnesses.

ROLLAND FORREST.
Witnesses:
Walter Forrest,
John Healy.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
J. A. SOLER.

GRAPHOPHONE ATTACHMENT. APPLICATION FILED OOT. $24,1908$.
1,001,780.
Patented Aug. 29, 1911.


Methesses.


# UNITED STATES PATEN' OFFICE. 

JOSEPH A. SOLER, OF CHICAGO, ILLINOIS.

GRAPHOPFONE ATTACHMENT.

## 1,001,\%80.

Specification of Letters Patent. Patented Aug. 29, 1911. Application filed October 24, 1908. Serial No. $459,308$.

## To all whom it may concern:

Be it known that I, Joseph A. Soler, a citizen of the United States, residing at Chicago, Illinois, have invented certain new and
5 uscful Improvements in Graphophone Attachments, of which the following, taken in connection with the drawing, is a description.

My invention has for its object the prographophones to reproduce the sound from the record.
Heretofore it has been customary to use a ncedle so constructed that one or two oper-
15 ations thereof dulls the point and it has to be replaced by a new one very frequently, and which, by the frictional contact with the disk over which the needle is moving, wears out the disk in a comparatively short time. hesstates constantly replensho the needles and buying new records. By niy improved needle these objections are overcome by the use of a needle having a point made of tempered steel, or a jewel and with
5 care can be used on lifty or more records. By tempering the steel and shaping the shank of the needle as shown, it is operated on a record with tess friction, thereby greatly prolonging the life of the record, at the
30 same time eliminating the grating and scratching occasioned by the use of the ordinary needte and reproducing the voice or music from the record with a molh smoother and sweeter tone then is now possible, with 35 the oft style needles.

In the accompanying drawings forming part of this specification, and in which like letters of reference indicate corresponding parts, I have illustrateal the esscmital feamat on ma withont in the least departing from the spirit thereof.

In the dranings in which :lll of the figures 55 are greally magnifiol, Fignte 1 is a fromt elevation of my invention showing the position of the needte in the record: lifig. 22 is a sedional view of the meedle with the cap siremed hareon; Fig. 3 is a side merntion alevation of the medte.

In cantrygr ont my invention a repre sents the ueedle shatik which may be of :1 size suituble to fit into the socket of any
machine now on the market. It the lower 55 end of the shank the diameter thereof is made smaller as at ", and is then shaped into the needle point $a^{\prime}$. The needle point $a^{\prime}$ is rectangular in cross section, the front enlge thereof being shown in Figs. 1 and 2 and 60 a side view in Fig. 4.

At a suitable place above the narrow edge of the needle point is an indicator or guile B which may be a small projection on the slank or may be a pin secured in an aperture in the shank, the purpose of this indicator being to insure the proper position of the needle when inserted into the socket of the machine. In the construction of the needles the point $a^{\prime}$ is hardened by a tempering process which remters it practically a diamond point and by elongat ing the point as shown in the drawing the rectangnlar portion thereof $a^{\prime}$ may be nsed upon a reeord matil it is worn to the shomlder $u^{2}$, which will require from fifty to seventy five records of the ordinary size.

To protect the point of the weedle when not in use I provide a (ap) 13 ' which is ' y lindrical in slape, the bore thereof being so closed at one end. This (a) lits (1) Wer the needle point and is held hy frimional contaed into engagement with the shank :1t the largest diameter thereof just abowe the shonlder $b$. By placing the (ap) "pon the 85 needle when it is not in nise prowents: an! seratching of the record by accedental disphacement and also proteds the point of the needle.

The adramtages of my insention will be 90 apparent to those skillod in the art.
My impromentents are wery simple in con
 and rhemply mamforlmed and wand in position, anil ande chlodual in all rexperds in 95 the performanace of their functions.
slight changes may be mate in the detait of constrinetion, and in the size shapere and
 Ing from the spitit of m! incontion or hat 100 ing its sisple: :and I therefore don mot winh to be limitad to the details as heres shown hant contomphate surd ehangen in the shapere ame propertions of the shank an fomm damiralde


1 daim:
. 1 needle of the dtase demwitued compri ing as shmul hur ing int ehngateal print of
temmered steel, shoulders $b$ and $a^{2}$ surrounding said shank, said shank having an opening therethrough extending in the line the needle is to travel, and an adjustable indi5 cator positioned in said opening, substantialty as described.

In testimony whereof I have signed this
specification in the presence of the two subscribing witnesses.

JOSEPH A. SOLER.
Witnesses:
Jajues P. Crane, Cifarles I. Cobb.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
J. H. ERICKSON.

PHONOGRAPHIC AUTOMOBILE ALARM. APPLIOATION FILED OOT. 24, 1910.
1,001,830.
Patented Aug. 29, 1911. 3 SHEETS-SHEET 1.

J. H. ERICKSON.

PHONOGRAPHIC AOTOMOBILE ALARM.
APPLIOATION FILED 0CT. 24, 1910.
1,001,830.
Patented Aug. 29, 1911. 3 SHEETS-SHEET 2.

J. H. ERICKSON.

PHONOGRAPHIC AOTOMOBILE ALARM.
applioation filed 0ot. 24, 1910.
1,001,830.
Patented Aug. 29, 1911.
3 SHEETS-SHEET 3.


# UNITED STATES PATENT OFFICE. 

## JOSEPH H. ERICKSON, OF SAN FRANCISCO, CALIFORNIA.

PHONOGRAPHIC AUTOMOBILE-ALARM.
1,001,830.
Specification of Letters Patent. Patented Aug. 29, 1911.
Application filed October 24, 1910. Serial No. 588,643.

## To all whom it may concern:

Be it known that I, Joseph IH. Erickson, a citizen of the United States, residing in the city and county of San Francisco and
5 State of California, have invented new and useful Improvements in Phonographic Au-tomobile-Alarms, of which the following is a specification.

This invention relates to a phonographic
10 automobile alarm, and particularly pertains to an automatic repeating attachment for phonographs and the like.

It is the object of this invention to provide an automobile alarm which is operated
15 by a phonograph so as to produce spoken or musical warnings, and to provide automatic means by which the warnings may be controlled and given repeatedly, if desired.
A further object is to provide mechanical
20 means by which quick action of the phonograph will be effected, both at the beginning and at the termination of the alarm, thus insuring the warning being quickly and sharply given and instantly cut off at its ompletion.
The invention consists of the parts and combination and construction of parts as hereinafter more fully described and claimed, having reference to the accompanyng drawings, in which-
Figure 1 is a side view of the invention with parts broken away. Fig. 2 is a front view of the same. Fig. 3 is a plan view of the carriage actuating mechanism. Fig. 4 ping deppe 5 , is a view showing the invention as applied.

In the drawings A represents the ordinary cytindrical phonograph record which is
40 nomed to revolve with :i drum 2 secumed to a shaft 3 supported at carh end in suitable bearings 4 , momiteal on a hase phate 13 , as is common in phonograph construction. The shaft 3 is rutated by means of a belt 5 which pasees aromed at wheel fo on the shatif 3 and a whed 7 on a slaft 8 lowated bememth the plate 13 and parallel with the shaft:3. The shaft 8 is supperted at hoth embls on :1 rockable frame !, pivoted at 10 , zome distamer
50 to the rean of the shath 8 , and is udapted to be rotated hy means of a friction hrive combposiced of a friction pulley 11 momited on the
 13. The pulley 11 is adapied to la (humwn

55 in and ont of conturd with the pulloy 12 hey rocking the fame! as hater deseriberl. This shalte 5 :3 is rotuted throngh a belt drive lyy
means of a small electric motor 14 disposed beneath the plate B ; the motor 14 being thrown in and out of operation synchronously with the engaging and disengaging of the friction pulley 11 with the pulley 12. This is accomplished by the following mech-anism:-An arm 15 extending beneath the frame 9 and pivoted at 16 contacts the un- 65 derside of the outer end of the frame and sustains it in its normally uppermost position with the pulley 11 out of contact with the pulley 12 ; the arm 15 being caused to continually press upward to lift the frame by means of a spring 17, which bears against the underside of the arm 15, as shown in Fig. 1. The outer end of the arm 15 projects beyond the end of the frame 9 and is provided with a contact plate 18 which connects with one pole of a battery 19 , the other pole of which comnects with one terminal of the motor 14. I knife 20 is disposed beneath the arm 15 in line with the contact plate 18 so as to be thrown into contact with the latter as the outer end of the arm 1.5 is pulled downward, as later deseribed; the knife 20 being electrically comected with the other terminal of the motor 14 . A cord 21 is attached to the onter end of the lever 8 15 and is intended to be comected to any suitable device or means for exerting a sulficient pull thereon in opposition to the spring 15 to throw the contact plate 18 into contact with the knife 20 , and thas complete a cil- 9 cuit from the battery 1! to actuate the motor If and at the same lime permit the frame (3) to drop downard and canse the pulley 11 to be engriged by the pulley 12 D to rotate the drum 2 and record 1.
 neceded to a lever 2.! which is : mapted to be actated by means of a phish hatton or tread 2:3, which inay he disporid at my commonent peint remote from the mechanisom jut de 100 scribed.
 rad which emgages with an blle ge:a de

 whon the shaft 3 is rewolved as before de siscribed.
 for e9: and berdle :3if of phatmeraph is -lidahs momited ont :1 shaft :31 intemtine 110
 - hal ft 2.
 itt its print of conturt therentill, st that
when engaged by the threaded shaft 27 the carriage 28 will be caused to more in one direction across the record $A$. as is well known in phonographe of this type. Normally the
5 needle 30 is held out of contact. with the record crlinder $A$. and the carriage 28 out of engagement with the threaded shaft $2 \overline{2}$, by means of a standard 32 mounted on the frame 9, the upper end of which is turned to
10 extend parallel with the record $A$ and to form a support upon which a projection on the outer end of the frame 28 is adapted to rest. From this it will be seen that when the frame 9 is allowed to drop downward by
I5 a pull on the cord 21 , the needle 30 will be thrown into contact with the record A . so as to ribrate the diaphragm in the sound bor 29 and reproduce the sounds originally recorded on the crlinder $A$; the carriage 28
20 carrying the needle 30 and sound box 29 being mored along by the threaded shaft 24 , which normally engages the carriage when the needle 30 contacts the record $A$.

By attaching the mouthpiece of the sound
25 box 29 to an automobile horn 33 by a flexible tube 34, as shown in Fig. 5. and mounting the whole derice upon an automobile an effective alarm or warning is obtained, which may be operated at will by pressing upon the
20 button 23. The exact expression of warning to be giren mar be anything suitable which may be produced by phonographic record, such as for instance, "Get out of the war," a bugle call or the like. alarms and constantlr a the wing means are constad foreat onatically turning the carriage 18 instantly to its normal position as soon as it has passed the alarm as lone as the arm 15 and frame are pulled down. This is accomplished by mounting a disk 35 on the front end of the carriage 28 in front of the standard 32. a abore on the back abore a rerticallr disposed plate 37 on the base plate B ; and haring a finger 38 extending downward bet ween two adjustable stops. 39-10. as shown in Figs. 2 and 4. When the outer end of the carriage 28 is in its lowermost position with the needle 30 in contact with the record A and the projection $28^{\prime}$ engaged by the threaded shaft 27 . the pin 36 will contact the plate 37 so that when the finger 38 comes in contact $\pi$ ith the stop 40 as the carriage 28 moves fornard. the disk 3.5 will be rocked on its bearing with the pin 36 acting as a cam on the plate 37 to raise the outer end of the carriage 28 and release the threaded projection $28^{\prime}$ from the shaft 27 whereupon a spring 41 on the shaft 31 will return the carriage 28 to its starting position. A spring 42 engages a notch 43 on the disk 35 to retain it in the position set
pleted its return, whereupon a lip $39^{\prime}$ on the stop 39 is encountered br the finger 38 which acts to restore the disk 35 to its normal position and allorss the front end of the carriage 28 to drop down as before, to be again carried across the record $A$.

The operation of the invention is apparent from the foregoing description; it being readily seen that when it is desired to give a phonographic alarm. a pull on the string 21 will allow the carriage 28 to gravitate downward to throw the needle 30 into operative engagement mith the record 1 . and at the same time start the motor 14 which revolves the record $A$ and mores the carriage 28 forward as before described. and that as long as the arm 15 is down by rirtue of the pull on the string 21 the motor 14 will continue to act and the carriage will repeatedly travel back and forth across the record by means of threaded shaft 27 . the trip disk $3 \check{5}$ and its co-acting parts and the spring 41 ; and that as soon as the pull on the string 21 is released the carriage 28 will be lifted up by the standard 32 and returned to its normal position by the spring 41 .

Haring thus described my invention. what I claim and desire to secure by Letters Patent is--

1. A phonographic automobile alarm comprising a revoluble record. a sound bor and strlus and amplifying horn. controllable means to mechanically engage and disengage the stylus and record, said means comprising a morable support for normally maintaining the strlus out of engagement with the record. a spring pressed member engaging the said support and holding it in an elerated position, and means for moring said member to allow the stylus to engage the record, a driving element. and a transmitting mechanism betreen said element and the record. and morable into engagement with the driving element substantially simultaneously with the engagement of the stylus with the record.
2. A phonographic automobile alarm comprising a revoluble record. a sound box and stylus and amplifying horn, controllable means to mechanically engage and disengage the strlus and record, said means comprising a morable support for normally maintaining the stylus out of engagement rith the record. a spring pressed member engaging the said support and holding it in an elerated position. and means for moring said member to allorr the stylus to engage the record, a driring element, and a transmitting mechanism between said element and the record, and morable into engagement with the driving element substantially simultaneously with the engagement of the strlus with the record. and means to automatically return the record and repeat the signal.
3. A phonographic automobile alarm, consisting of a revoluble record, a sound box and stylus, and amplifying horn, a motor, a pivoted frame for normally holding
5 the stylus out of engagement with the record, a spring pressed arm engaging the frame and normally holding the same in an elevated position, a motor, means for retracting the arm to allow the frame to drop
10 so that the stylus may engage the record, electrical connections for energizing the motor substantially simultaneously with the engagement of the stylus with the record, and driving connections between the
15 motor and the record, one of said connections being carried by said arm.
4. In apparatus of the character described, the combination with a revoluble record, a sound box and stylus, and an
20 amplifying horn, of means for holding the stylus normally out of engagement with the record, a motor, means interposed between the stylus and the motor for normally supporting the first named means, connections een the motor and the second named means by which the motor is started substantially simultaneously with the release of the stylus supporting means and the engagement of the stylus with the record, and driv-
30 ing connections between the inotor and the record, one of said connections being carried by the stylus supporting means.
5. The combination with a phonographic record, sound box, stylus and amplifying
35 horn of a motor and a friction drum driven by said motor, a companion drum, a hinged lever upon which said drum is jommaled, pulley and belt connections bet ween said drun and the revoluble record, means by
40 which the record friction drum is nomally held ont of contact with its driver, and means by which the drums are brought into contact and the motor energized in mison.
6. The combination of a phonographic

45 record, somed box, styhis and amplitying hom, of a motor, a frictional drum driven therely, a second drum, a hinged lever upon which said second drum is jommaled, belt and pulley comnedions between said secomed
50 trime and the recond, a spring actuated lever wherehy the first mamed lever ant its frictional drom are nomally maintained ont of contact with the motor drixen drum, as switech lowated in the motor cirenit, satid
55 switch having a fixed member and at member movable with the spring lever, and commections wherely said! lever may be de pressed to close the switelt and emergize the motor and to allow the frictional drom to
60 drop into contact so as to impel the resoluble recorrl.
7. In a phonograph having a revoluble phonographic record, a stylus and a reciprocal stylus carrying carriage adapted to gravitate into operative contact with the 65 record, a spring actuated support for normally holding the stylus out of contact with the record, means for depressing the spring, yieldable means for normally retaining the styhs in the starting position while the latter is out of contact with the record, automatic means for lifting the stylus out of contact with the record to allow said yieldable means to instantly return the carriage and stylus to the starting position while the aforesaid yieldable means is compressed to cause a repetition of the travel of the stylus along the record, said last named means comprising a disk pivoted to the carriage, a pin on the disk eccentric to the pirotal point thereof, and means for rocking said disk to cause said pin to bear against said support to lift the carriage.
8. The combination in a phonograph having a revoluble record, a carriage reciprocal $\mathrm{s}_{5}$ above the record and a stylus on the carriage adapted to contact the record, a spring for holding the carriage and stylus free from the record, means for depressing said spring from a distance to allow the stylus to engage 90 the record, means for rotating the record, threaded means for moving the stylus carriage in one direction across the record while the stylus is in contact therewith, yieldable means for instantly returning the stylus carriage the moment the strlus is lifted from the record, and means for antomatically lifting the stylus from the record at a predetermined point in the forward movement of the carriage, sad last named means consisting of a trip member piroted on the carriage, a fixed smport, a pin on the trip member adapted to be calleat to bear against the fixed support to lift the trip member and the carriage therewith, an ad 105 justable stop) to adtuate the trip member on its: forvard movement to callse it to lift and support the carriage, a detent for holding the (rip) member fixed while the earriage moves back and an aljustable stop for again actating the trip at the end of the momer movement to tele:ase the detent and :allow the stylus to agatin drop back men the rew wed to repeat the forward monement.

In testimony "hereof I have heremtos set 115 my hand in the presenter of two sulmothbing wituesses.

> .JOSEPH H. たRICK゚ON.

Witnesses:
Joun H. Hhmande


## J. H. MASSEY.

ACOUSTIC DIAPHRAGM.
APPLICATION FILED MAY 22,1911
1,001,968.
Patented Aug. 29, 1911.


Witnesses:
Oscar Still beaut. Q.OTA


# UNITED STATES PATENT OFFICE. <br> JOHN H. MASSEY, OF PROVIDENCE, RHODE ISLAND. 

ACOUSTIC DIAPHRAGIN.
$1,001,968$.
Specification of Letters Patent. Patented Aug. 29, 1911. Application filed May 22, 1911. Serial No. 628,611.

## To all whom it may concern:

Be it known that I, Joinn H. Massey, a citizen of the United States, residing at Providence, in the county of Providence, or worte Istand have imrented a certain new and useful Improvement in Aconstic Diaphragms, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention has relation to acoustic diaphragms such as are employed in talking machines and the like.
It consists in a diaphragne of improved construction and character, the features of which I will first explain with reference to the illustrated emborliments of the invention, and then particnlarly point ont in the claim at the close of this specification.

In the drawings,-Figure 1 shons in diaphragm embotying the invention and Fig. 2 is a view thereof in cross section in the plane of the line A-13 of Fig. 1. Figs. 3 and 4 are views similar to Figs. 1 and 2, showing another embodiment of the insention.

In the construction of my diaphragin I employ a disk 1 of paper materiat, which latter I prefer to metal, as being more duraWe than the lattere not subjeed to oxidation. and giving beter tome resnlts. I have shown (ommbined with the satid disk as sorcalled amss-heard 2 for service whent the diaphragm is nsed in a machine requiting at diaphergm to haye such reoss-hemed. Ifiaplatagms for use in machines not rerpiring rows-heads in commedion with the diaphatgins will be made withomt aross-heals.

Tos the sur faces of the disk 1 I apply conatings :3, 3". of bron\% powder in laceper: Therely a firm, smooth, and waterproof sim
facing is provided, and the durability of the article increased, and better tone resilts are secured.
To the bronze coating $3^{a}$ at the immer side of the paper disk I apply a coating $t$ of shellac, and before such coating dries I apply thereto a layer 5 of tissue paper. The shellac gives a harder surface, and the tissue paper serves to reinforce and help the tone. To the exposed face of the tissin paper layer 50 is I apply a final layer or coating 6 of shellac. This gives a hard firm waterproof finish to the imer surface of the complete article.
In some cases the diaphagm may have made therein holes or perforations 7.7 . Figs. 3 and 4. of varying shapes and proportions in the paper disk 1. which are bridged by the tissme paper $\delta$. althongh msinally the said disk will be muerforated as in Figs. 1 and 2.
Practical experience with my inproved diaphagen shows that it vichles al mullh greater volmme of tone with clearen anticnTation than in the case of many of the diaphragms heretofore in ase.

What is clamed as the invention is:
An aconstir diaphragm ronsisting ol : a disk of paper material, homze coatinqupon the (wo faces of suld disk, a cobather of shellate upon one of such burnke coatinge, as laver of tisump paper npon sud comting of Whellace, and ar ceatin! of shellare upen the expered fare of the tisishe papere.
In fost imme whereof allix my signatme
in presere of two wimesers.
JOHN H. M.SNSEI.
Witurs.es:
Guns. li. Ricmod.
N.тй: B. D.s.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of lalents.

## W. H. MILLER.

 PHONOGRAPH.Patented Aug. 29, 1911.



## UNITED STATES PATENT OFFICE

# WALTER H. MILLER, OF ORANGE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY. 

## PHONOGRAPH

1,002,0\%4.
Specification of Letters Patent. Patented Aug. 29, 1911. Application filed January 18, 1909. Serial No. 473,001

To all whom it may concern:
Be it known that I, Waltie H. Miller, a citizen of the United States, and a resident of Orange, comnty of Essex, and State of
5 New Jersey, have invented a certain new and useful Improvement in Phonographs, of which the following is a description.

My invention relates to phonographs, and particularly to phonograph horns and means 10 for supporting the same.

In my application Serial No. 430,259 , filed May 1, 1908. I disclose a structure in which the horn is provided with a straight section arranged parallel to the path of the travel-
15 ing carriage of the phonograph as the latter traverses the record in reprollucing the same. A tapered tube member connected to the reproducer neck is arranged, in the above describerl application, to slide back and
20 forth in the fixed tube above referred to with the movement of the traveling carriage whereby bending and twisting stresses "pon the telescoping parts are avoided.

This application is an improvement on 25 the above constrinet inn. which consists chiofly in the provision of a member slidably mgaged within the rigid thbe member, and fitting smagly therefin, in which member the end of the thibe sedtion, which is attached to
30 the repmortucer neck, has a minersal joint. By this means an improved joint is provided between the teleseoping pats wherely losis of air is prevented, while at the same time. the advantages accruing from the climinadiom of stresses are retainerl.

In order that the invention may be fully maderstood, reference is heredey made to the arcompanying hawings, which form a part of this sperification, wheren.

Figure 1 monesmes my impored hom am! commections appled to a phomonapho. which later is shown in doted lines, ame rig. 2 is a detail eretiomal view of the hearing member in the rigrid tube cularged to
45 show the buethoul of ermberting hagethere tha parts of the same.

In the daratings, the momern! I indiatases Hu phonograph to which my imporemmat is applied. I have fomme ii (onvonionl la
50 cumbed my rigid folo. whinh is aramged
 graph reppoduco (0) the phomograpla lay meanc of a batckel sermed latheren of the

forwardly: and toward the end of the instrument in such a manner that the rigicl tube may be connected by alu upward bend to the lower face of the sald bracket simbstantially on the central longitudinal line of the instrument and at the cond thereof opposite the end gate or the end of the phonograph mandrel upon which the record is inserted. The bell-shaped month piece of the horn is comected to the upper face of the bracket and is preferably so momed that it may be made for rotate in a horizontal plane as is common.
The bracket above deseribed is represented by the reference momeral 2. The rigid tube which is parallel to the path of the reproducer is indicated by the momeral 3. and the bell shaped portion of the horn. which is commected to the upper side of the bracken as above described, is represented by the referene momeral t. It is to be moderstond that while I prefer to provide the common simponeting means for the month piere + and the rigid tule 3 in the neighborlhood of one end of the instrment and at a short distane therealowe. This deviere may be stmpported from the phomograph cabine loy any convenient form of sipport as well act hat which I have deseribed and shown. 'Thon member for comecting the merk of the reproducere at the erytindrical tulae 3 is dese ignated be the refereme momeral ti. This hollow member is peforably dapering in form and its smaller ond is preferably removably commeded to the reprohlwer nerk ab mems of the cllow 7 . In matwatly mojoceling bead os is preferably formed men f.he member 15 and somes bo dedemime the pr-ition of the ellow ? Hemen. 'Ther larer

 This lits smory within the show on sticlime member 10 which tidingly matace whin






is formed of (wo members 11 and $1:$ in order





bers 11 and 12 may be placed on the outside of the spherical end 9 of the tube 6 and may conveniently be secured together as by screw thread engagement of a flange on
5 the sections 11 and 12 , as indicated at 13 in Fig. 2. The end 9 of the tube 6 with the shoe 10 carried thereby may then be inserted within the end of the rigid tube 3 in which it is then adapted to slide in the course of the forward and backward travel of the phonograph carriage.

In operation, the slidable member 6 is carried with the reproducer and telescopes within the tube 3 with entire absence of the stress or strain which has always been found so objectionable in all cases where a joint has been inserted between a movable member such as the traveling carriage of the phonograph, and a stationary member, such as the horn. When a record has been played and it is desired to move the reproducer back to its original position, the reproducer is raised in the usual fashion so as to disengage the feed nut from the screw and is 25 pushed back to its original position.

It will be noted that with the device shown, a horn of any convenient size may be used, since, when the horn is turned so as to be directed endwise of the phonograph, as shown, the entire length of the phonograph cabinet serves as a supporting piece for the horn, rendering it practically impossible to orerturn the cabinet by the use of a horm of any reasonable size. The horn, 35 howerer, may be turned in any desired direction as is evident.

Having now described my invention, what I claim and desire to secure by Letters Patent of the United States is as follows:

1. In a phonograph, the combination with a horn section and means for supporting the same, of a movable reproducer, and telescoping connections between the horn section and the reproducer', comprising a tube fixed with its longitudinal axis parallel to the path traversed by the reproducer in its
movement, an annular shoe slidably mounted in said tube, and a hollow tapering member pivotally connected with said shoe and communicating with the reproducer, substantially as described.
2. In a phonograph, the combination with a horn section and means for supporting the same, of a movable reproducer, and telescoping connections between the horn section and the reproducer, comprising a tube fixed with its longitudinal axis parallel to the path traversed by the reproducer in its movement, a shoe slidably mounted in said tube, and a tube communicating with the reproducer and having a ball and socket connection with said shoe, substantially as described.
3. In a phonograph, the combination with a horn section and means for supporting the same, of a movable reproducer, and tele-
scoping connections between the horn section and the reproducer, comprising a tube fixed with its longitudinal axis parallel to the path traversed by the reproducer in its movement, annular members slidably mounted in said tube, and a tube communicating with the reproducer and having an enlarged rounded end embraced by said annular members to constitute a ball and socket joint, substantially as described.
4. In a phonograph, the combination with a horn section and means for supporting the same, of a movable reproducer, and telescoping connections between the horn section and the reproducer, comprising a fixed tube, a member slidably mounted in said tube, and a tube communicating with the reproducer and having a ball and socket connection with said member, substantially as described.

This specification signed and witnessed this 16 day of January 1909.

WALIER H. MILLER.
Witnesses:
Dyer Sintir,
Anna R. Klehm.


## M. G. GRAHAM, DEC'D.

M. A. GRAHAM, ADMINISTRATRIX. PHONOGRAPH HORN.

## 1,002,205.

Patented Aug. 29, 1911. 2 SHEETS-SHEET 2.


Ifitizesses,
Surle Nesitui/s Hohr Nitelso

Miles G.Graham, Inventor,

attorzzey.

# UNITED STATES PATENT OFFICE. 

## MILES G. GRAHAM, OF ALBANY, NEW YORK; MARY A. GRAHAM ADMINISTRATRIX OF MILES G. GRAHAM, DECEASED.

PHONOGRAPH-HORN.

To all whom it may concern:
Be it known that I, Miles G. Grahams, a citizen of the United States, residing at Albany, Albany county, New York, hare
5 invented a new and useful Improvement in Phonograph-Horns, of which the following is a specification.

My invention relates to phonograph horns, or, more broadly, to sound amplifyresonating devices such as are used on phonographs or other sound reproducing machines.
It is intended to produce a derice which shall greatly amplify, purify and resonate the sounds emitted from such machines; which shall particularly adapt such machines to reproduce music originally rendered by an orchestra, whether brass, string or full, as well as the human voice either speaking or singing; and which shall be adjustable as to some of its parts, so as to adapt it more exactly to different uses.

To this end, it consists of many novel fertures, which may be combined as shown; or they may be, in some cases, employer singly in comnection with other well known horns; or they may be mited in smaller combinations, i. e.. certain parts may he advantageonsly nsed withont others.

In the cxample of my invention which I have selected for ilhustration, Figures 1. 2 and 3 are respectively, a left side elevation, a top plan view and a right side elevation of the deviee, all partly broken away. and atl showing in dotted lines the phongraph or like machine, which forms no part of my invention: Figs. 4 and 5 are partial longitudinal vertical sections of the two end portions of my device.
In the drawings. 11 designates a benela or stand, shown as comsisting of a top 12 and Iwo side legs of supports 13 , having an opening between then. On the top 12 of the stand are secherd two sockets 14. carying two vertically adjustable legs 15. which support a saddle 16 of arc-shaped. trongllike form. Also serned to the stamed 11 is a vertical standard 17. admpeded ly muy well known nuans. mot shown, to detachatly en gage: hom supporting rox, as will hore after appear. From the (op) 12 of the stand rises 1 rod 18 , at the frece end of which is a semi-circular hom supporting bomet 19. The stand 11 is intended to smport any form of sonnd recording or reproducing
machine, shown in the present instance as a "Victor" phonograph. To the coupling member of the phonograph is detachably secured in the nsual manner, a coöperating
coupling member 20, which will of course vary in style to fit the particular machine employed. The tube 21, which is integral with or secured to the member 20 , is fitted snugly within the end of a long coiled tube 22, preferably made of rubber, under which
term I include rubber coated fabric, as ordinary hose pipe. Is shown. the coil consists of a plurality of turns of equal diameter and of a size to encircle the phonograph or like instrument. the ends of the coil extending tangentially, one to engage with the coupling derice, the other with a horn. as hereafter described. I have found it advantageous to make this tube of not less than one inch interior diameter and 16 feet long, the length of the lowest "C" closed diapason pipe of an organ. though tubes of 8.4 or 2 feet, or indeed of any multiple of 2 feet. possess certain advantages. I have also fonnd that the resonating or sound carrying capacity of the rubber tube is increased by impregnating its imner surface with a suitable resimous or gum-beaning solntion. To this end. T prefarably introduce into the tube a quantity of hemlock-spruee oil. turn the tulae so as to bring the oil into contact with the entire surface, allow a proper time, say 3 to 5 days. for absorption, and porr out the residue. The tule 22 is coiled so as to loosely (mblate the stand top 12 and secmed live metal bands 23. The free tangemtial, enil $2 t$ of the tube 22 is exteriorty cint awne to form a portion 2.5 of redticed diameter. over which is sectured a shot thbe of of thin flexible material. ns geldhemeres skin, which propects heroml the emt of the tulne 22. Serored wer this tangentinl emel 21 of the tabe 22 is a metal steeve 27. which also prepects beyond the coml of the tube. lint

 and the consegment ammhar space between the parts esf amb 27 . is free to vihate fors

 fit on the sleme $2 \pi$. is integral with or so curvely combeded to the smallar or thement (mul 2 ) of a conical hom 30. the body pers tion 31 of which is best made of copper.
85
while the sleere 28 is preferably made of sheet brass, or other metal or alloy. On the sleeve 27 is a series of marks 32 forming a graduated scale for conveniently adjust5 ing or readjusting the longitudinal relations of the tube 22 and the horn 30 . see Fig. 2.
I considerable portion of the forward or mouth end of the hom body 31, is cut away. 2,3 and 4 . and a stout circular metal hoop 33. the are of which corresponds to that of the remaining metal segment, is rigidly secured to the end thereof. The partially flarcompleted by means of a segment or gusset of parchment, rellum or like material 34 , which is tightly stretched and secured to the free part of the hoop 33 and to the edges erably secure the segment 34 at the edges of the body 31 by means of flat bars 37 and a curved plate 38 , between which and the body 31 the parchment is engaged. the parts $3^{3}$. playing in slots 40 in the body 31. By the nse of these elongated slots 40. I am enabled at any time to take up any slack or wrinkles which may occur in the segment 34 .

Within the metal body portion of the horn 30. and preferably at the rear of the flexible segment or gusset 34 . I rigidly secmre a block 41 of metal. which supports one or more ribrating gongs 42. I prefer to emstance an octare, of such gongs. which may be of desired form, preferably coiled bars. such as are used in cathedral clocks. see Figs. 2 and 4. supporn 30 is supported at its throat end by the bracket 19. in which the sleeve 28 slides, and at its month end br a telescopic rod 43 detachably engaged with the rod or standard 17 and
45 carrring at its free end a chain or cord 44 connected to a loop 45 secured to the upper side of the horn. In practice I find it adrantageons to make the horn withont the usual flaring metal portion at the mouth
50 end, $i$. c.. with an approximately continuous taper from end to end except as to the parchment portion.

In Fig. 5 of the drawings, I have shorn an additional derice which I may emplor
55 in order to still further amplify the sound. It consists of a tapered tube 46 within the coupling tube 21 and with its smaller end secured to the member 20 so as to register with the aperture therein. The tube 46 may be
60 tapered thronghout its length, as shown, or at least at its free end. which is snugly embraced by the tube 21, the tubes 21 and 46 being this held in concentric relation.

It will be seen that my device in its en-
tirety constitutes what may be called an 65 "orchestraphone," that is, a sound purifying, resonating and tonalifying derice adapted to reproduce tones of every pitch and timbre, so that it is particularly adapted to music originally produced by an orchestral containing instruments of various sorts. This adaptation is achiered by the use of the long semi-flexible tube through which the sounds pass and in which scratching and like disagreeable noises appear to be taken up; by the employment of a great variety of vibrating substances, from the light and delicate membrane 26 to the heavy gongs 42 , which are acted upon and seem to accentuate notes at different points of the scale: and br the adjustability of the horn 30 . by which the membrane 26 may be held within the sleeve portion 28 of the horn or thrust forward a considerable distance into the throat end of the horn itself.

As already stated the different features of my derice as described act cumulatively, so that substantial gains in tone porter and sweetness may be obtained even where certain of them are omitted. Hence, I do not wish to be limited to the use of the entire combination shown. or otherwise except as set forth in the claims. It is also clear that many mechanical changes may be made in my device without departing from the spirit of my invention. Thus, the vertical arrangement of the coiled tube the prorision for separating the stand. coil, horn. etc.. for packing and for their easy reassembling, and other features of the sort, are within the prorince of the mechanic.

It will be understood that my device may be used in producing records as well as in sound reproduction, and that the phrase "sound amplifring device" is used in the claims in its broad sense, as including any modification of the tone. The phrase "talking machine" is also used in certain of the claims in its broad sense to include any machine for the production or reproduction of 110 sound records.

What I claim is:

1. In combination, a talking machine; and a sound amplifying member therefor, including a coupling member, a rubber connecting tube attached to said coupling member, the interior surface of said tube being coated with a sound resonating material. and a tapered horn. independent of and connected with the free end of said tube.
2. In combination. a talking machine; and a sound amplifying derice therefor, including a coupling member. a rubber connecting tube attached to said coupling member, the interior surface of said tube being coated with a gum-bearing solution, and a tapered horn, independent of and connected with the free end of said tube.
3. In combination, a talking machine; and a sound amplifying device therefor, including a coupling member, a rubber connecting tube attached to said coupling member, the interior surface of said tube being coated with a resinous solution, as hemlock-spruce oil, and a tapered horn, independent of and connected with the free end of said tube.
4. In a sound amplifying device, a rigid, 0 non-collapsible, tapered horn in two parts, one of which is of rigid material and extends the entire length of the horn, and the other of which is of flexible material and of less length than the hom, said rigid part be5 ing provided with means for holding said flexible part in permanent stretched position.
5. In a sound amplifying device, a rigid, non-collapsible, tapered horn in two parts, one of which is of metal and extends the entire length of the horn, and the other of which is of tegumentary material and of less length than the horn, said metal part being provided with means for holding said tegumentary part in permanent stretched position.
6. A sound amplifying device including a tube of substantial length; a tube of vibrating membrane secured at the free end of said first named tube; and a tapered horn also mounted at the free end of said first named tube and surrounding said membranous tube.
7. A sound anılifying device including a tube of substantial length; a relatively short tube of thin flexible material, as goldbeater's skin, secured at the free end of said first named tube; and a tapered horn also mounted at the free end of said first named
tube and surrounding said membranous tube.
8. A sound amplifying device including a tube of substantial length; a tubular vibrating membrane secured at the free end of said tube and extending therebeyond; and a tapered horn slidingly mounted on the free end of said tube, whereby said membrane may have longitudinal movement within the throat of said horn.
9. A -ound amplifying device including a tube of substantial length; a sleeve sur- 50 rounding the free end of said tube; a tubular vibrating membrane secured at the free end of said tube, said membrane being of less diameter than said sleeve and projecting therebeyond; and a tapered horn slidingly mounted on said sleeve.
10. In a sound amplifying device. a coupling member having a central aperture: an outer tube rigidly secured to said member; and an inner tapered tube having its smaller end secured to said member and connected with said aperture and having its free fllured end located within said outer tube.
11. In a sound amplifying device, a coupling member having a central aperture; an outer tube secured to said member; and an inner tapered tube having its smaller end secured to said member and having its flee flared end located within and bearing against said outer tube, whereby said tubes are held in concentric relation.

## MILES G. GRAHAM.

Witnesses:
Geo. R. Kehoe,
Joun H. Keiso.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Pateats, Washington, D. C."

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1,002462
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J. W. AYLSWORTH. PROCESS OF MAKING DUPLICATE SOUND RECORDS. APPLIOATION FILED JAN. 29, 1908.
1,002,482.
Patented Sept. 5, 1911.
Fig. 1


Frig. 3
 Filo.z



# UNITED STATES PATENT OFFICE. 

## JONAS W. AYLSWORTH, OF EAST ORANGE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

PROCESS OF MAKING DUPLICATE SOUND-RECORDS.
$1,002,482$.
Specification of Letters Patent. Patented Sept. 5, 1911.
Application filed January 29, 1908. Serial No. 413,168.

## To all whom it may concern:

Be it known that I, Jonas W. Aylsworth, a citizen of the United States, residing at 223 Midland avenue, East Orange, county
5 of Essex, and State of New Jersey, have invented certain new and useful Improvements in Processes of Making Duplicate Sound-Records, of which the following is a description.

My invention relates to an improved duplicate sound record made of metal, or provided with a metallic wearing surface, and to an improved process of making the same, the object of the invention being to provide
15 such a metallic record which shall be a very close copy of an original master, and to provide a process or method of produeing them, which shall be capable of being carried out commercially in an effective way. Cylindri-
20 cal sound records at the present time are generally made of a wax-like material molded or east within a hollow matrix, and disk records are formed of a somewhat harder material employing considerable
25 quantities of shellac, the impression being secured from a flat matrix. In either ease, the reeords are subject to wear which would be very largely increased if the attempt were made to materially diminish the size
30 of the record groove. Cylindrical and disk records have also been made of a tongh material, like celluloid, but such records are generally of poorer quality than those formed of a wax-like material, and they over a ceal to deteriorate with time. Moreto objectionable wear if the attempt were made to materially diminish the size of the record groove. The making of duplicate
40 copies of sonmd records in metal hus also been suggested, but in every case so far ms I am aware, when this has been done, the matrix has becu destroyed so that the process would be obvionsly misuited for use for the
45 commercial mannfacture of metrllic duphicates.

In order that the invention may be better moderstood, attention is directed to the we-
companying drawing, forming part of this specification, and in which-

Figure 1, is a section of a cylindrical mold many times enlarged and illustrating the duplication from a master having a record groove only three-thousandths of an inch in width, a portion of a metallic film being illustrated as being formed in the mold; Fig. 2 a cross-sectional view of a matrix or mold illustrating the manner of removing the duplicate record therefrom; Fig. 3 a longitudinal sectional view showing a complete cylindrical record with a metallic wearing surface; and Fig. 4 a corresponding view showing a disk record with a metallic wearing surface.

In all of the above views, corresponding 65 parts are represented by the same numerals of reference.

The matrix 1 shown in Fig. 1, is of the usual construction, being formed on its interior with a negative representation of a master record, and being produced by electroplating in any ordinary or smitable way. When the record to be duplicated is of disk form, the usnal matrix for the purpose will be employed. I propose to electroplate a metallic film on the negative record surfare of a matrix, whether of disk or cylimlrical form, and in order to prevent thie electrodeposited coating from ndhering imtimately to the matrix, I first coat the latter with ain excessively thin mon-metullie: filun. which while it will adhere sulficiently to permit the electrodeposit to be made. will, with relative facility. permit the eledrodemosir to be strippet free of tha record surfate. Preferably, for this pmpose 1 form upon the record surface of the matrix, nur exemsively thin mom metaltio film produced by exposing the surfore for a slort time to the smoke or sapor of a highly hemted mesin gime resulting in the deposit on the recorel surface of " mictusconially thin hyer therenf, substumt ially wherent mad miforme theronghont med of suel relative thimeses as not to interfere with thre minute details of thre record surface. 'The mutrix, while it is
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$\qquad$
$\square$7075
being thus exposed to the vapor of a highly heated hydrocarbon, may advantageously be connected to a source of static electricity which attracts the smoke or vapor and facili-
5 tates the formation of a more uniform film on the record surface thereof. When an excessively thin non-metallic film has been applied in this way to the record surface, I apply to the same a thin film of very finely
10 dirided graphite which is lightly burnished with a soft brush so as to thereby remove all particles which do not adhere to the nonmetallic film.

In the drawing, 2 represents the usual 15 nickel or gold deposit which is electroplated on the matrix so as to reduce oxidation, 3 the non-metallic film, and 4 the conducting film of graphite, all of these films, however, being somewhat exaggerated in
20 thickness for the purpose of clearness. Having treated the matrix in this way, it is now placed in an electroplating bath and connected as a cathode, and a sufficiently thick layer of nickel or cobalt, or other rela25 tively non-oxidizable metal is plated on the graphite film, so as to thereby form the layer 5, which constitutes the metallic surface of my improved record. This deposit may be given any desired thickness, say
30 from one-hundredth to one-tenth of an inch, or more. During this plating the ends of the matrix as well as its outer surface, may be protected by a coating of varnish, paraffin, or other suitable material, so as to any part of the matrix, except its record surface. Having obtained a metallic shell carrying on its surface the positive representation of the record to be duplicated, I
40 remove the same from the matrix in any suitable way. When the matrix is flat, obvionsly the deposited record may be simply lifted off or stripped off by prying a sharp instrument between it and the matrix, but
45 when the deposit is made in a tubular matrix, it is collapsed inmardly, as shown in Fig. 2, and, in this way, removed. After the electrodeposited shell or disk has been obtained in this way, it is mounted on a
50 suitable cylindrical backing 6 (Fig. 3) or flat backing 7, (Fig. 4).

In constructing cylindrical records, the backing may be conveniently formed of plaster of Paris, which is cast within the
55 shell in any suitable way, or the backing may be formed of papier-mâché, or other very cheap material, orer which the electrodeposited material may be slipped, so as to be held in place by friction. In the mann-
60 ufacture of disk records the electrodeposit may be cemented or otherwise secured to a disk of paper or other cheap material. In every case, the material comprising the sup-
port or backing should have a relatively low coefficient of expansion, in order that any 65 expansion or contraction to which it may be subjected will be within the elastic limits of the metallic film.

Records made as I have described can be manufactured with relative facility and are able to withstand enormously greater wear than is possible with duplicate records as now made, and this is so even when the record groove is of as fine a width as threethousandths of an inch.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is as follows:-

1. The process of making metallic duplicates of sound records, consisting in first applying to the negative record surface of a matrix or mold, a thin film of a non-metallic relatively non-adherent material, in applying a conducting material to said film, and in electroplating a metal on the conducting material, and in finally separating the electrodeposited metal from the matrix, substantially as set forth.
2. The process of making metallic duplicates of sound records, which consists in applying to the negative record surface of a suitable matrix an excessively thin deposit of a hydrocarbon in finely divided condition, then in applying a conducting material to such a deposit, then in electroplating a metal on the conducting material and in finally removing the electrodeposited metal from the matrix. substantially as and for the purposes set forth.
3. The process of making metallic dupli- 100 cates of sound records, which consists in subjecting the record surface of a suitable matrix to the vapor or smoke of a highly heated hydrocarbon, so as to produce an extremely thin coating of hydrocarbon in excessively finely divided condition on the record surface, then in applying thereto a conducting material, then in electroplating a metal on the conducting material, and in finally separating the electrodeposited metal from the matrix, substantially as and for the purposes set forth.
4. The process of making metallic duplicates of sound records, which consists in applying an excessively thin film of hydrocarbon in extremely finely divided condition on the record surface of a suitable matrix, then in applying a suitable conducting material thereto, then in lightly burnishing the conducting material, then in electrodepositing a metal on the conducting material, and finally in separating the electrodeposited metal from the matrix, substantially as set forth.
5. The process of making metallic dupli- 125 cates of sound records, which consists in
connecting a suitable metallic matrix to a source of static electricity, then in subjecting the record surface to the effect of a hydrocarbon vapor, so as to deposit a thin 5 film of excessively finely divided hydrocarbon particles on the record surface, then in applying a conducting material to said film, then in electroplating a metal on said conducting material, and in finally separating
the electrodeposited metal from the matrix, 10 substantially as and for the purposes set forth.

This specification signed and witnessed this 21 day of Jan. 1908.

JONAS W. AYLSWORTH.
Witnesses:
Frank D. Lewis,
Anna R. Klehm.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

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1,002+7 ?
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## E. L. AIKEN.

PHONOGRAPH.
1,002,479.
Patented Sept. 5, 1911.
2 8EEETS-SHEET 1.



# UNITED STATES PATENT OFFICE. 

## EDWARD L. AIKEN, OF EAST ORANGE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNIIENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

## PHONOGRAPH.

1,002,4\%9.
Specification of Letters Patent. Patented Sept. 5, 1911. Application filed June 28, 1905. Serial No. 267,337.

## To all whom it may concern:

Be it known that I, Edward L. Aiken, a citizen of the United States, residing at East Orange, in the county of Essex and State of
5 New Jersey, have invented certain new and useful Improvements in Phonographs, of which the following is a description.
My invention relates to phonographs and similar talking machines, on which provision
10 is made for automatically stopping the rotation of the mandrel when the end of the record has been reached, and more particularly to instruments of this character in which a spring motor is used for furnishing
15 the driving power.
My invention has for its object the application of such means to phonographs as now built and on the market, preferably in such a way that the device will be for the most
20 part concealed so as not to detract from the appearance of the instrument.

My invention also has for its object to simplify the construction in such a manner that the brake which is automatically applied for stopping the spring motor will also act as a frictional member for determining the speed of rotation of the motor during the operation of the instrument.
With these ends in view my invention con-
30 sists in the features heremafter set forth and claimed.

Reference is lereby made to the accompanying drawing, in which-

Figne 1 is a plan and Fig. 2 a front ele-
35 ration showing in dolled lines a phonograph of ordinary construction and in full lines one form of device in which my invention may be embodied together with those parts of the phonograph to which it is applied and 40 with which it coëperates.

In the device shown, a lever 1 is piroded at 2 Io a hag 3 secmed to or interral with the body of the instrment. 'The lowere end of the lever extends laterally from fhe bedy
45 thereof and is formed with a soncket I for receiving a piece of felt or other yiodling materiat fa to be pressied against the lame of the disk 5s arried in a well known mamer by the slecere of of the wovernom shall 5
50 Jhring tho operation of Che instrmment the lever I orempies the position ilhstrated in the drawing, wherelys the fielt t" is withdanwir into shell a prisition as bather the moter to start mad guin speed mitil the finer
of the disk 5 is brought into frictional en- 55 gagement therewith, at which time the motor will be running at such speed as to produce the usual number of revolutions per minute of the mandrel, and will be prevented from gaining additional speed. The lever 1 is 60 normally held in the position shown, by a rod 8 pivoted thereto at 9 and extending longitndinally of the instrument. A collar 10 is fixed to an intermediate portion of the rod and a coil spring 11 surrounds the same, being placed between the said collar and the vertical web 12 of the body of the instrument. The tonsion of the spring tends to move the rod 8 longitudinally foward the left and thereby press the block $4^{a}$ of the 70 lever 1 against the goremor clisk 5) to stop the motor. The rod 8 is, howerer, normally held against such movement by a latch $1: 3$ pivoted at 14 to the frame and having a portion 15 which projects in the path of the rear portion of the lift lever 16. One emal of the rod 8 is provided with a collar 19, secured thereto by : pin 20, and having :a vertical pin 19$)^{2}$. A lever 17 is piroted at 15 to the frame, and has a slot $19{ }^{n}$ to rective 80 the pin 19 . The rod 8 is held against the tension of the spring 11 by the shombler 21 of the latch $1: 3$ against which the shopt arm of the lever 17 pressies:

It will be obrions that when the lift lever 85 16 reaches the projection 1.5 of the lateln 1:3 it will canse the same to turn om its pisol 11 . wherely the shombler 21 will be mased :almow the cmid of the lewer 17 mud the tension of the spming 11 will therempen dran the rod 8 towam the lefo themed amsing ha hork
 the gevemon disk is and to theredy stap the
 with the lewer 17. and the lathe is nas ful an !as a hand loner for placing the sprine maler tension when it is desised to onermate the





 ath that the latch 13 may la dripped at any
 ،arvich by the mandrel.

It shoild be moted that the attathament dantibed is antried antirely by the man
frame or body $c$ of the phonograph and is not connected in any way with the motor frame $a$. The frame $a$ is preferably floated between springs $\zeta, b$, so that vibrations set and gearing will not be transmitted to the body of the instrument, which means for supporting the motor frame is described and claimed in Letters Patent No. 798,4īs, dated tion of the body of the instrument from the ribrations set up by the motor is not interfered with by the application of the present invention to the instrument.
Haring now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a phonograph, the combination of a body, a motor, a traveling carriage ac-
20 tuated thereby, a member rotatable by the said motor, a piroted lever morable into engagement with said member, a longitudinally movable rod attached at one end to said lever and having its opposite end probody tending to move the rod longitudinally a hand lever connected to said rod pirotally, a latch for normally holding the lever against the force of said means, said latch
30 having an arm projecting into the path of the carriage, substantially as set forth.
2. In a device of the class described, the combination of the motor having a sliding governor disk, a longitudinally movable rod,
35 a friction pad adapted to engage said disk and connected to said rod, a spring applied to said rod and adapted to cause the pad to engage said disk and stop the motor, and holding means connected to said movable
40 rod, and comprising a hand lever for placing said spring under stress and a latch for holding said lever against the action of the spring, substantially as set forth.
3. In a phonograph or allied talking ma-

45 chine, in combination with the main frame or body carrying springs and a traveling somud box carriage, of a motor frame floated between said springs, driring mechanism including a motor, governor and governor disk
carried by said motor frame, and releasable means carried by the body of the instrument and out of contact with the motor frame for pressing against said governor disk to stop the motor, said means being released by the sound box carriage, substantially as set forth.
4. In a phonograph or allied talking machine, in combination with the main frame or body carrying springs and a traveling sound box carriage, of a motor frame floated between said springs, driving mechanism carried by said motor frame, and releasable means carried by said body and out of contact with said motor frame for stopping the motor, said means being released by the sound box carriage, substantially as set forth.
5. In a phonograph or allied talking machine, in combination with the main frame or body carrying springs, and a traveling sound box carriage, of a motor frame supported by said springs, driving mechanisin including a motor, governor and governor disk carried by said motor frame, and releasable means carried by the body of the instrument and out of contact with the motor frame for pressing against said gorernor disk to stop the motor, said means being released by the sound box carriage, substantially as set forth.
6. In a phonograph or allied talking machine, in combination with the main frame or body carrying springs, and a traveling sound box carriage, of a motor frame supported by said springs, driving mechanism carried by said motor frame, and releasable means carried by said body and out of contact with said notor frame for stopping the motor, said means being released by the sound box carriage, substantially as set 90 forth.
This specification signed and witnessed this 26 th day of June 1905 .

EDIVARD L. AIKEN.

Witnesses:
Delos Holden.
Frank L. Dyer.

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1,002,5-9
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## F. L. DYER

PROOESS OF MARING METALLIC DOPLICATE SOOND RECORDS.
APPLIOATION FILED JAN. 27, 1908.
1,002,659.
Patented Sept. 5, 1911.
Fig. 1


Wimesses:


Herbert At Ayke

# UNITED STATES PATENT OFFICE. 

FRANK L. DYER, OF MONTCLAIR, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

## PROCESS OF MAKING METALLIC DUPLICATE SOUND-RECORDS.

1,002,659.<br>Specification of Letters Patent. Patented Sept. 5, 1911. Application filed January 27, 1908. Serial No. 412,741.

## To all whom it may concern:

Be it known that I, Frank L. Dyer, a citizen of the United States, residing at Montclair, county of Essex, and State of 5 New Jersey, have invented a certain new and useful Process of Making Metallic Duplicate Sound-Records, of which the following is a description.
My invention relates to an improved proc-
10 ess for making metallic duplicate sound records, whether of cylindrical or disk type, and my object is to provide a very simple process which can be carried out on a commercial scale for the production of an un-
15 limited number of accurate metallic duplicates from a single mold or matrix. Metallic duplicates thus made will permit the effective production and reproduction of a record of very great fineness, say, of three20 thousandths of an inch, or less in width.

The invention resides in the fact that by producing on the record surface of the matrix or mold an excessively thin coherent layer of so-called "cement copper," and by
25 electroplating the inctal thereon, the adhesion between the particles of cement copper and between the latter and the matrix or mold, on the one hand and the electrodeposited metal on the other, is so slight as to
30 permit the ready separation of the electrodeposited metal, after which any of the ecment copper adhering thereto, or to the mold, can be easily ribbed off. When the mold or matrix is of a tubular form, the
35 electrodeposited metal will exist as a shell and can be removed by collapsing the shell inwardly, but when the matrix or mold is in the form of a flat disk, the electrodeposited metal can be freely stripped off of the
40 same. The"shell or disk obtained in this way, carving the mperentation of the receord to be duplicaterl, is supported on at suitable fonndation.

Tu order that the invention may be better
45 mederstond, attention is directed to the alecompanying drawing, forming pat of this speceification, and in which -

Figure 1 is a sectional virw 01101 ch-

50 mold with its film of coment coppore deposit ed on the record sumface thereof, mal with the clectrodeposited layee constimting the recomel surface of the inplimate; Fieg. 2 a erosis-sectional visw illustrating the maner
of removing the electrodeposited shell from 55 the tubular mold; Fig. 3 a longitudinal sectional view of the composite cylindrical record with a metallic surface.

In the above views, corresponding parts are represented by the same numerals of 60 reference.

The mold 1, is of any suitable character, being either tubular or of disk form, and is provided with the usual negative record surface, as shown. I place the mold in a suitable cobalt plating bath, prefcrably a concentrated solution of cobalt chlorid with cobalt anodes, and plate on the record surface an exceedingly thin film or blush of cobalt 2. which may be less than 0001 of an inch in thickness. During this plating, the mold is preferably rotated so as to make the plating uniform. The mold is now washed and is then immersed in a solution of copper sulfate, the reaction cansing the cobalt to go into the solntion and the copper to be deposited as "cement copper" in a minutely gramular but slightly adhesive form. Preferably, the immersion is continned only long enongh to result in the corering of the cobalt film with a perfect layer of cement copper, so as to leave a part of the cobalt filn still intact. If all the cobalt were dissolved in the copper sulfate batlo. there might be danger of the electrodeposited film being plated imperfectly at lirst. since it is deposiled under :s condition of tension, but it will he mulematomb of comrse. that if desired, the entime film of cobalt may. be redneed to cement empler. Instend if first depositiner on the mold at hin blus of of cobalt, as explained, any other meral might be used in comedion is ith which sulbitun tially the same remetions bake place, for insstance, irme. Itaving roated the remed surlime of the matrix or mold with :at exeessively thin likn of emment copper, as ex
 he:mien depusit 3, of : smitable metal, !poun which the rewed is lo be mathe. 'This is 100

 tione which lume bern inemplat, the matris or mold, exepp for ins rewod anface is pro
 (10) stmes similar muterial, st that die phat ing operations will he combined to the rewerd sinface. The shell or disk of nicher or other
metal. which has thus been formed (depending. of course, whether the mold is tubular or di-k-like) is remored, which can be readily effected, owing to the slightly adhesive When the mold is tubular, the shell is pref erably collapsed, as shown in Fig. 2. Haring obtained a shell or disk of electro-plated metal, carrying an accurate copy of the on a suitable foundation 4 , of plaster-ofParis, or papier mâché. It will be understood that in order to facilitate the stripping of the electrodeposited duplicate from deposit in position. may be subjected to a deposit in position, may be stionected co a thirty to forty per cent. solution of cyanid of potash. br which the cement copper will be dissolved, so as to entirely free the elec-
20 trodeposited layer, but ordinarily this is not necessary, since the adhesion of the particles of cement copper is so slight as to permit the electrodeposited layer to be readily stripped from the matrix or mold.
Having now described my invention, what I claim as new and desire to secure by Letters Patent is as follows:-

1. A process for making metallic duplicate copies of sound records, which consists for the purposes set forth.
2. A process for making metallic dupli-
cate copies of sound records, which cousists in electroplatiug on the record surface of a matrix or mold an excessively thin film of in applying to the record surface of a matrix or mold, a very thin film of granular slightly adhesive cement copper, in electroplating a thin and relatively non-oxidizable metal thereon, and in finally separating the electro-
5 deposited metal from the matrix or mold, substantially as and for the purposes set forth.
3. A process for making metallic duplicate copies of sound records, which consists 0 in applying to the record surface of the matrix or mold, an excessively thin film of cobalt, in then subjecting the deposited film to a copper solution to thereby result in the formation of granular slightly adhesire cement copper, in electrodepositing on the cement copper a hearier layer of metal, and in finally remoring the latter deposit, substantially as and for the purposes set forth.
4. A process for making metallic dupli0 cate copies of sound records, which consists in rotating a matrix or mold in a cobalt plating bath, and in depositing on the record surface of the matrix or mold an excessively thin film of cobalt, in then subjecting the cobalt film to a copper solution, resulting in the formation of granular slightly adhesive cement copper film, in then electrodepositing a metal thereon, and in finally removing the electrodeposited metal, substintially as and cobalt, in subjecting said film to the effect of
a copper solution so as to convert a part only of the film to granular slightly adhesive cement copper, in then electroplating a metal thereon, and in finally remoring the electrodeposit, substantially as and for the purposes set forth.
5. A process for making metallic duplicate copies of sound records, which consists in applying to the record surface of the matrix or mold, an excessively thin film of a metal haring the porrer to replace copper in a copper solution, in then subjecting the deposited film to a copper solution to thereby result in the formation of granular slightly adhesive cement copper, in electrodepositing on the cement copper a heavier layer of metal, and in finally remoring the latter deposit, substantially as and for the purposes set forth.
6. A process for making metallic dupli cate copies of sound records, which consists in rotating a matrix or mold in a plating bath and in depositing on the record surface of the matrix or mold an excessively thin film of the metal the salt of which is in solution in the bath, the metal being one having the power to replace copper in a copper solution, in then subjecting the film so deposited to a copper solution resulting in the formation of a granular slightly adhesive cement copper film, in then electro-depositing a metal thereon, and in finally removing the electro-deposited metal, substantially as and for the purposes set forth.
T. A process for making metallic duplicate copies of sound records, which consists in electro-plating on the record surface of a matrix or mold an excessively thin film of a metal having the power to replace copper in a copper solution, in subjecting said film to the effect of a copper solution so as to convert a part only of the film to granular slightly adhesive cement copper, in then electroplating a metal thereon, and in finally removing the electro-deposit, substantially as and for the purposes set forth.
7. A process for making metallic duplicate copies of sound records, which consists in applying to the record surface of the tubular matrix or mold an excessirely thin film of a metal haring the porrer to replace copper in a copper solution, in then subjecting the deposited film to a copper solution to thereby result in the formation of granular slightly adhesire cemeut copper, in electroclepositing on the cement copper a heavier layer of metal to form a positive record, and in finally removing the latter from the mold and the cement copper by collapsing the same, substantially as and for the purposes set forth.
8. A process for making metallic duplicate copies of sound records which consists in applying to the record surface of a matrix or mold, a very thin film of granular

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slightly adhesive cement copper, and electroplating a thin deposit of metal thereon, in dissolving out the cement copper by a solution of cyanid of potash, and finally sep5 arating the electro-deposited material from the matrix or mold, substantially as and for the purpose set forth.

This specification signed and witnessed this 25 day of Jan. 1908.

FRANK L. DYER.

Witnesses:
Anna R. Klehar,
Frane D. Lewis.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

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1,003474
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S. LEVIN.

STYLUS FOR SOUND REPRODDCING MACHINES.
APPLIOATION FILED SEPT. 19, 1910.
1,003,474.
Patented Sept. 19, 1911.

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# UNITED STATES PATENT OFFICE: 

SAMUEL LEVIN, OF HIGHLAND PARK, ILIINOIS.
STYLUS FOR SOUND-REPRODUCING MIACHINES.
$1,003,4 \% 4$.
Specification of Letters Patent. Patented Sept. 19, 1911. Application filed September 19, 1910. Serial No. 582,674.

## To all whom it may concern:

Be it known that I, Samuel Levin, a citizen of the United States, residing at Highland Park, in the county of Lake and State
5 of Illinois, have invented certain new and useful Improvements in Styli for SoundReproducing Machines, of which the following is a specification, reference being had to the accompanying drawings.
This invention relates to styli for soundreproducing machines of the gramophone type, and has for its object to produce a new and improved form of stylus which may be used a great many times without
15 injury either to the stylus or to the disk record so that the operator is relieved of the necessity of changing the stylus at each operation as is necessary in the use of a stylus of the ordinary type. I accomplish this object by the use of a stylus having a jewel point of a peculiar form, as illustrated in the dramings and hereinafter specifically described.

That which I believe to be new is set forth
In the drawings,-Figure 1 is a fragmentary side view of the rotary table and record disk of an ordinary gramophone, with the ordinary reproducer in position
30 thereon with the stylus engaging the soundgroove in the record, the view being toward the center of the rotary table. Fig. 2 is an enlarged detail, being a very much enlarged section on the line 2-2 of Fig. 1, and showis a still more enlarged detail, being an enlarged section on line 3-3 of Fig. 2. Fig. 4 is a section on line $4-4$ of Fig. 3. Fig. 5 is a vien of the jewel as seen from the right in 0 Fig. 3.

Referring to the several figures of the drawings, in which the corresponding parts are indicated by like reference characters,10 indicates a reproducer of the ordinary
45 general type, of which 11 indicates the socket-member in which the stylus 12 is to be inserted, being retained in position therein by the set-screw 13 .

14 indicates the rotary table upon which 50 the sound-record 15 is revolved in the direction indicated by the large arrow in Fig. 1.
As best shown in Figs. 3 and 4, the stylus proper or stem 12 is provided with a deep groove 16 at one side at the lowrer end. 17
indicates a jewel secured in said groove by
means of cement or in any other suitable inanner. As best shown in Fig. 3, the jemel is substantially in the shape of a semi-circle, with the straight side of the jewel set at an angle of approximately sixty degrees to the face of the record, and with the curved portion of the periphery of the jewel in advance in the direction of the movement of that portion of the record with which the jewel is in contact. That is to say, the straight edge of the jewrel is first brought into contact with the successive variations in the record groove. The edge of the jewel which is toward the center of the record is rounded off (see Figs. 2, 4 and 5) so that the jewel is in effect substantially plano-convex, the edge which is toward the outside being also very slightly rounded as are also the points of the jewel, as best shown at 18 in Fig. 3.

I have found by experience that a stylus of this character is very efficient. The sound-groove of the record does not become quickly worn but on the contrary the record still retains its superiority after having been used a great many times with a single stylus. The jewel is large enough in cross-section to insure its being not easily broken, and its peculiar shape with the flat face outside enables the stylus to traverse the groove many times following closely the original sinuous outline without materially wearing away the fine points along the sides of the groove. Moreover, I have found that as the jewel is gradually worn, the wear is such as to preserve substantially the original shape of the engaging point of the jewel.

What I claim as my invention and desire to secure by Letters Patent is,-

1. A stylus for sound-reproducing machines of the gramophone type, the operative point of which is plano-conrex, the edge of said point which first engages the variations of the record groove being straight and set at an angle to the face of the record.
2. A stylus for sound-reproducing machines of the gramophone type, the operative point of which is formed of a thin substantially plano-convex jewel whose lower pointed end is defined by a straight line and 105 a curved line, said jewel being positioned so that its straight edge first engages the variations of the record groove in the rotation of the record, said straight edge being set at an angle to the face of the record.
3. A stylus for sound-reproducing machines of the gramophone type, the operative

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point of which is formed of a thin substantially plano-convex jewel whose lower pointed end is defined by a straight line and a curved line, said jewel being positioned variations of the record groove in the rotation of the record, said straight edge being at an angle to the face of the record the convex face of said jewel being positioned toward the center of the record.
4. A stylus for sound-reproducing machines of the gramophone type, the operative point of which is formed of a semicircular plano-convex jervel having its edges bein poitions lu rol being positioned so that its straight edge first engages the variations of the record groove in the rotation of the record, said straight edge being at an angle to the face of the record.
5. A stylus for sound-reproducing machines of the gramophone type, the operative point of which is formed of a semicircular plano-convex jewel having its edges
25 and its points slightly rounded, said jewel being positioned so that its straight edge first engages the variations of the record groove in the rotation of the record, said straight edge being at an angle to the face
being positioned toward the center of the record.
6. A stylus for sound-reproducing machines of the gramophone type, comprising a stem and a thin substantially semi-circular plano-convex jewel secured to the lower end of said stem with the straight edge substantially parallel with the stem.
7. A stylus for sound-reproducing machines of the gramophone type, comprising a
stem and a thin substantially plano-convex jewel secured to the lower end of said stem, the lower pointed end of said jewel being defined by a straight line and a curved line, said straight edge being substantially paral45 lel with the stem.
8. A stylus for sound-reproducing machines of the gramophone type, comprising a stem and a thin substantially plano-convex jewel secured to the lower end of said stem, the lower pointed end of said jewel being defined by a straight line and a curved line, said straight edge being substantially parallel with the stem, the operative point and the edges of said jewel being slightly rounded.

SAMUEL LEVIN.
Witnesses:
C. E. Pickard, W. H. De Busk.
T. H. MACDONALD.

DIOTAPHONE RECORDER AND REPRODUCER.
APPLICATION FILED JULY 28, 1910.
$1,003,625$.
Patented Sept. 19, 1911.


# UNITED STATES PATENT OFFICE. 

THOMAS H. MACDONALD, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR TO AMIERICAN GRAPHOPHONE COMPANY, OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF WEST VIRGINIA.

DICTAPHONE RECORDER AND REPRODUCER.
$1,003,625$.
Specification of Letters Patent. Patentell Sept. 19, 1911.
Application filed July 28, 1910. Serial No. 574,314.

## To all whom it may concern:

Be it known that I, Thomas II. Macmonald, of Bridgeport, Connecticut, have inrented a new and useful Improved Dicta-
5 phone Recorder and Reproducer, which inrention is fully set forth in the following specification.

This invention relates to talking machines designed for dietation purposes where it is 10 desirable to have the recorder and the reprodncer combinerl in a single instrument, to the end that the operator may readily shift from recording to reproducing, or rice rersa, and more particularly the invention
15 relates to the recording and reproducing elsment, or, as it is now technically known in the art, the combined recorder and reproducer. In this art, it is recognized that the recording device shonld be lighter than the
20 reproducing device, or, to express it another way, that the recording levice should exert less pressure upon the reeorl than does the reproducing deviec. It has. therefore been proposed to make the wecorder-reproducer
25 with a single diaphragm having at recording stylus and a reproducing stylus momest thereon and to provide means for shifting the recorder-reprodneer so as to brine citl er one of the styles into operative relation with posed to monnt a weipght directly mpon the
 thereto. the relation of the paite lowing such that when the recorder-wemerbuer is ad fistert into peproctucing position tom wemon exerts a preater pressume throment the style upon the reenerd than it dowes when the re-corder-meproducer is :uljusted into pecomed ing position.
 Angust 29: 1908, T have shmin muld ite seribed, amone other thingse ar monder ore






 with means for adding the weitht to the rex

phragm. when the instrument is in reproducing position, and remoring the weight therefrom when the instument is in recording position.
My present invention is an improrement on that slown in waplen apation and it consists, generally speaking. in a combined recorder and reproducer having a single diaphragm with two stylus points seenred thereto and a weight pirotally momed directly upon the recorder-reproducer (instead of independent thereof as in my former application), with means for reliering the recorder-reproduce of the greater part of the weight when the instrment is in recording position and for applying the entire weight of the reeorder-reproducer when the same is in reproducing position.

More specifically stated, the invention consists of a combined recorder-reproducer of the character last deseribert with a weight having its main fortion located approximately over the reending and wemonding styles and provided with a phatity of arms comented by a smitable piont to the re-corder-mpmorducer at or ne:m the neek pmrtion therenf.

I have shown the invention in the aeromp:aying dratwinges in wholl

Figure 1 is a tertimal sedion thromeh the
 phome dowinge the eminhined recorder re-s perdureer in reprodncinar poition: and lair. 2 is a sulmantial homizontal sed fon thongh
 its comberting parts.

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shown and described in my U. S. Letters Patent 569,290, dated October 13, 1896.

The casing 12 of the carriage has a tubular piece 13 secured thereto by flange 15, and $s$ receiving the tube of the mouth piece at its reduced end 14. Tube 16 telescopes within the tube 13 and is capable of longitudinal movement with relation thereto. The trumnion tube 17 is piroted within the tube 16 by piro pin 18, while de recorder-reproducen 19 is secured to the inner end of the trumion tube 17 by the horizontal pin 20 which permits the recorder-reproducer to move up and domn on said pirot. A set screw 21 passes
15 up through the bottom wall of the fixed tube 13 and through the longitudinal slot 22 of the telescoping tube 10. thus permitting the telescoping tube 16 to have free longitudinal movement, while the pin 21, by reason of its 20 engagement in the slot 22 . prevents any axial or turning movement of the tube 16 . The diaphragm 23 has a recording style 24 and a reproducing style 2.5 in position to operatively engage the record 20 . The diaerably of metal, having a tubular opening $19^{\prime}$ formed therein with the diaphragm secured opposite one end of said opening in the usual or any suitable manner. said carimg. as previonsly describe being carried on the transverse pivot 20 . The said mounting. the diaphragm. and the tiro styles 24 and 25 together constitute the recorder-reproducer as a whole. A link 27 is pivoted to the ring 7 at the nose 11 and is provided with a slot 28 engaging a horizontal pin 29 on the telescoping tube 16, the link 27 and pin 29 being held in engagement by spring 30 mounted within tubular part 31
40 piroted at 32 to the casing 12 and secured at its lower end by pirot and slot engagement to the link 27 .

Referring to the pin 21 (Fig. 1), the same is in a position to coöperate with a cam face seats 39 and 40 . Then the pin is in the seat to, the reproducing point is in operative relation with the record: when the cam face 38 rests 1 upon the pin 21 the recordernucer is lifted from the record so that neither style contacts therewith: and when the pin 21 is in the seat 39 the recording style 24 is in operative relation with the record.

As thus far described, the construction is the same as that shown. described and claimed in my aforesaid application Serial No. 450.811 . The essential difference between the construction of the present invenbecitand hat chown in my sald application resides in the novel manner of monnting the weight. The weight in the present instance consists of the part 33 and its rearwardly extending arms. 34.34 , which arms instead of being pivoted to the frame of the ma-
chine independently of the recorder-reproducer or the diaphragm mounting, are piroted directly upon the recorder-reproducer or diaphragm mounting, thereby simplifying the construction and, as experience has proved, producing equal if not better results. As in the construction of my aforesaid application, the weight is prorided with a nose 36 adapted to engage the adjacent seat 37 in the casing 12 .

The operation will be understood by referring to Fig. 1, where the parts are shown in reproducing position. When the lever 8 is arjusted into vertical position, the link 27 will throw the telescopic tube 16 forward and with it the recorder-reproducer until the cam 38 of the recorder-reproducer rests upon the pin 21 , thus elevating the reproducing style from the record and, of course, elerating the weight 33, 34, 34. The continued shifting of the lever from the vertical position to the left in Fig. 1 will adrance the parts to the point where the nose 36 mill engage the seat 3 T in the frame 12 , white the seat 39 of the recorder-reproducer will come opposite the pin 21 , thus permitting the recorder-reproducer to descend, bringing the recording style 24 into contact with the record. By shifting the lever 8 in the reverse direction, the reverse morement will be secured. thins withdrawing the nose 36 of the weight $33,34,34$ from the seat 37 and permitting the parts to return into the position shown in Fig. 1. It will thus be seen that the greater and most effective portion of the weight is withdrawn from the recorder-reproducer when the same is in recording position, but is returned to the recorder-reproducer when in reproducing position. thus automatically obtaining the desired result. viz., a recorder that is comparatively light and a reproducer that is comparatively heary.

Having this described my invention, what is claimed is:

1. In a sound recording and reproducing machine, an instrument comprising a single diaphragm and a mounting therefor, two stylus points mounted upon said diaphragm one for recording and the other for reproducing. in combination with a weight monnted directly upon the diaphragm mounting and wholly supported thereby during the reproducing operation and means other than the diaphragm monnting for supporting a portion of the weight for the recording operation and for returning it to the diaphragm inminting for the reprorucing operation.
2. In a sound recording and reproducing machine. a combined recorder and reproducer, a carriage pirotal connections between said recoider and reproducer and the carriage, a weight piroted directly mon the recorder-reproducer adjacent to the pivot
point of the latter and supported wholly specification in the presence of two subupon the recorder-reproducer when in reproducing position, and means withdrawing a portion of said weight from the recorder-
5 reproducer when the parts are in recording position.

In testimony whereof I have signed this scribing witnesses.

THOMAS II. MACDONALD.
Witnesses:
Edna Thorpe,
A. B. Keough.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

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## C. B. REPP.

## PHONOGRAPH.

APPLICATION FILED JUNE 24, 1909.
$1,003,655$.
Patented Sept. 19, 1911.
2 SHEETS-SHEET 1.


## C. B. REPP.

PHONOGRAPH,
1,003,655.
Patented Sept. 19, 1911. 2 SHEETS-8HEET 2.


Attest: B.S. Damelo P.R. Mering.

Chistin BRepter Inventor: by G a qure 9 Nentwarth his Atty.

# UNITED STATES PATENT OFFICE. 

CLINTON B. REPP, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-HALF TO WILLIAM E. COOK, OF ROXBURY, MASSACHUSETTS.

## PHONOGRAPH.

$1,003,655$.

Specification of Letters Patent. Patenterl Sept. 19, 1911. Application filed June 24, 1909. Serial No. 503,978.

## To all whom it may concern:

Be it known that I, Clinton B. Repp, a citizen of the United States, residing in the borough of Manhattan, in the city, county,
5 and State of New York, have invented certain new and useful Improvements in Phonographs, of which the following is a specification, reference being had therein to the accompanying drawings, which form a part
10 thereof.
My invention relates to phonographs, and more particularly to the mechanism relating to sound translation.
The main object of the invention is to 15 provide a phonograph wherein the somnd waves of the record will be accurately transmitted to, and reproduced by, a diaphragn with a large volume of resultant sound wates so modified as to have clearness of
20 cone as well as accuracy of reproduction, all vibrations other than those due to the indentations upen the record being eliminated or lost during the transmission of the vibrations from the reprodncer point to the dia-
25 phragm.
A further object is to provide a phonograph wherein any cross vibrations due to The movement off, or actating mechanism for imparting movement to, the diaphragm
30 and its somm box will be elmmated or arvided.

A still further object is to provide a ploonegraph wherem the diaphragm may be placed and maintained meder at constant ten-
35 sion to insure such sensitiveness (a) vibralions thereof as will sechro lhe interepplion of exera minute vilatations will a resultant Wran, :hat exat reproxluction wl the sommd waves repreented by the imentations mon
40 the reend, with exery detail acemblaterd.
I still further utjond is to provide a phor negraph wheren the diaphagom will be plateed muler a cemsianl Consion, and satid

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 He sibntions fiom and empodertion of the


 sumbl box will be lixed relative for he reated,
and the reproducer point and the vibratory members interposed between the suid point and the said diaphragm will be capable of such movement relative to the record as will permit the reproducer point to follow the spiral trend of the indentations of the record.

A still further object is to provide a phonograph wherein the diaphragm and its 60 sound box will be fixed relative to the record. and the reproducer point will be propelled along the record throngh its engagement with the indentations theren, the vilmations: set up by such engagement being transmitted to the diaphrigin by interposed vibratory members the first of which carries said reproducer point and has a swiveling relation to the diaphragm.

A still further objed is to provide a plor- 70 nograph wherein the pressure of the repudncer point will be entirely imbependent of the means tensioning the diaphragn.

A still further objeet is to provide a phonnograph wherein the wants parts inci- 75 dental to the (emsioning of the diaphagm and the exertion of pressime of the mprodurer point mpen the rewod will be sar comstroded and artanged as mot to diwn or absort vibrations of the vibatory members. or set up cross vibations resulting in falte tones in the sombl wprodnediond die to the action of Wase vihrations ment the diaphrigum.

A still firther whent is to pronide othor.
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 Ha axis of said malins, whemin the menc. ments of salial arm will le penitively delimed (6) peront a diypatement of patio on int




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 milled lọ the puint la atid memhor withom se bor por sound box is about midway between the ends of the mandrel $a$ and its contained record $b$, and is immovable relative thereto. The and is immovable relative thereto. The
sound box $e$ has the ordinary somnd opening 60 and ontlet $f$ adapted to receive the horn $g$. The manner of attachment of this horn, however, diflers from that of the ordinary
phonograpl in that it may be turned comhowever, diflers from that of the ordinary
phonograph in that it may be turned completely around to any point without interpensively produced and which will reproduce sounds in great volume, and with accuracy.

The invention consists primarily in a phonograph embodying therein a diaphragm, means placing same under tension, a reproducer point and a vibratory member between said point and said diaphragm, whereby the ribrations resulting from the engagement of said point with indicated sound waves on a record will be transmitted from said point to said diaphragm through said vibrator member; and in such other novel features of construction and combination of parts as are hereinafter set forth and described and more particularly pointed out in the claims hereto appended.

Referring to the drawings:-Figure 1 is a side elevation of a phonograph embodying my invention, the diaphragm and its sound box being shown in vertical section; Fig. 2 is a front view thereof; Fig. 3 is a plan view thereof, and Fig. 4 is an enlarged sectional detail riew of the diaphragm, sound box, interposed vibrator member and reproducer point.

Like letters refer to like parts throughout the several views.

In the accompanying drawings, I have not shown and I will not describe in detail, the mechanism rotating the record, it being apparent that any record actuating means may be employed, this invention having to do with the transmission of the vibrations necessary to reproduce through the diaphragm, those waves recorded upon the wax or other cylinder.

In the drawings, the support for the record is shown as an ordinary mandrel $a$ which may be rotated about a horizontal axis by means of any desired mechanism. The record shown at $Z$ is of the ordinary cylinder type.

Off-set relative to the axis of the mandrel $a$ and cylinder $Z$, is a supporting frame $c$ for
50 the diaphragm $d$ and its sound box $e$. The coustruction and arrangement of the sound box $c$ may be the same as now ordinarily used, differing therefrom, however, in the respect that the diaphragm does not carry 55 the reproducer point. The center of the fering with the connection between the horn
likelihood of the loss of any sound wares, or the modification of the length of such vibrations. Ind a still further object is to provide a phonograph which may be inex-
and the outlet. A detailed description of this manner of mounting the horn will be more fully entered into hereinafter.
The sound box being distant from the record, it is apparent that some means for transmitting the ribrations indicated on the record must be provided, which means will have the two-fold function of carrying the yibrations and following the record, or the indentations thereon which have a spiral trend. The essentials of this interposed vibratory transmitting mechanism are susceptibility of responding readily to the vibrations produced by the sound record without absorbing such vibrations, and adaptability of movement circumferentially of the diaphragm without interrupting such vibrations. This mechanism embodies therein a vibrator arm $h$ the outer end of which carries the reproducer point $i$ which point is firmly secured to and in intimate contact with said arm so as to transmit the ribrations thereto, either by being firmly embedded therein alone, or by means of a metallic mounting, and the inner end of said arm is mounted relative to the center of the diaphragm $d$ in a manner to transmit the vibrations from said arm to said diaphragm, the connection being such as to permit a swiveling or rotary movement of said arm circumferentially of said diaphragm. The arm $h$ may be made of any desired material taking any desired form although by experiment I have demonstrated satisfactorily that a soft, close-grained wood, such as bass wood, or American linden, results in not only an exact reproduction of the sound vibrations through the absence of crosstones or blasts, but modulates these tones so as to result in a softness or streetness in the reproduced tones without diminishing their volume. Preferably the connection between the inner end of the arm $h$ is by means of a strand $j$ of waxed thread secured to a headed stud $k$, the head of which bears upon the diaphragm $d$ and the stem of which has an opening therein throngh which the strand $j$ is looperd. It will be observed that this strand is flexible, thus permitting the arm $h$ to turn readily through that arc necessary to bring it into engagement with all parts of the record $Z$. The twisting of the strand $j$ while impairing the transmission of the vibrations to a certain extent, does not otherwise effect the mode of operation of the derice.
To permit the transmission of the vibrations of the arm $h$ to the diaphragm $d$ throngh the strand $j$ it is necessary to tauten this strand. which tautening also accomplishes the tensioning of the diaphragm itself in a manner to make it extremely sensitive. The agency employed for accomplishing this tattening of the strand and tensioning of the diaphragm must be so arranged
as not to interfere with the free swiveling movement of the arm $h$. Preferably this means consists of a coiled spring $l$ one end of which is formed into an open loop or

$$
h^{\prime} \text {, which is the conne }
$$ between the arm $h$ and the strand $j$. The other end of this spring is secured to a hook or loop $m$ mounted in a cross-head $c^{\prime}$ of the frame $c$, the said cross-head $c^{\prime}$ being directly below the center of the diaphragm $d$.

The tension of the diaphragm $d$ will be controlled by the tension of the spring $l$, and as the sound reproduction may be controlled through the tension of said diaphragm, I preferably provide means for varying the tension of the said diaphragm through a variance in the tension of the spring l. This adjustment is accomplished 20 by making the shank of the hook or loop $m$ screw-threaded and passing it through an opening in the cross-head $c^{\prime}$, the nut $m^{\prime}$ and lock nut $m^{2}$ being used for drawing said hook or loop toward the cross-head to increase the tension of the spring $l$ or permit the tension of the spring $l$ to draw said loop toward the diaphragm, and locking said hook or loop in the adjusted position. The open hook $l^{\prime}$ at the top of the spring $l$ is of the vibrations or the formation of crossvibration at the point of connection between said spring and said arm. The hook or loop $h^{\prime}$ is made large in order to provide that clearance necessary to permit the hook to turn freely, relative to both the strand $j$, or hook or loop $l^{\prime}$.

If desired, other comnecting means between the arm $h$ and the diaphragm $d$, and other means tensioning the diaphragm may be employed without departing from the spirit and scope of the invention.

In order to caluse the onter end of the arm $h$ and the reprodacer point carried the record $b$, means exerting a downward pressure upon satid arm must be employed. To a woid the necessity for always having the phonograph upon a level, this means prefany consists of a conled spring $n$, the opposite ends of which respectively are formed into hooks and attached to the open hook (01 loop $m$, and a hook $h^{2}$ upon the arin $h$ adjacent to the inner end therenf. The con-
55 needions between the spring $n$ and the hookis or loops on $h^{2}$ respectively must be such as to permit the swiveling movement of these parts retative to eacle other, which may be ateromplished in the simpleat form ly mems
60 of loxped commerions having sumble chatmes as will aroil! a tight fit and at consepment binding at Ulis pmint.

It will be ohserved that the spring $l$ is uttacheol to the salme lower center ats the 65 hook $n$, thas cmasing the axis of rotation of
the arm $h$ and its pressure spring to be the same.

The top of the sound box $e$ is provider with a circular recess $e^{\prime}$ having an outer flange $l^{2}$ in which recess $e^{\prime}$ is mounted a fitting o having an enlarged base and an angularly projecting tube $o^{\prime}$ adapted to carry the horn. The opening in the base of the fitting o has a close sliding fit to the casing forming the sound opening $f$, the said fitting being attached to the sound box by means of this fit so that the horn may be turned in any direction being capable of describing a complete circle about the sound ontlet or opening $f$.

To prevent as much as possible the vibrations of the spring $l$ with resultant crosstones or blasts, from the diaphragm, I use a muftler upon said spring consisting of a flange $p$ having a resilient lining such as soft rubber, in contact with said spring, without exerting sufficient pressure thereon to effect the tension of the spring. 'This mufiler is not essential to the operation of the device, but may be used to secure the highest efliciency by the elimination of all vibratious upon the diaphragm other than those passing through the vibrator arm $h$.
To place limitations upon the movement of the arm $h$ both its rotary movement and its vertical movement in order to prevent accidental injury to the reproducer point by engagement with the mandrel $a$ or other parts of the phonograph other than the record $b$, I provide a guide $q$ composed of a frame adjacent to the onter end of the sail arm $h$ which frame has a slot therein throngh which the said arm passes. This slot is of a width so as to be free of the arm $h$ when said am is in operative engagement with the record $b$, allowing additional chamane above said arm to permit the reproblucer point to be taised out of engagement with the record and brought to the starting point. The clearance below said wom is merely enongh to prevent the emgagement of the arm therevith when the mprodnerer puint is in engagement with the reveral, than camsing the lower edge of satid slot to suppent the arm at other (imes. Beyond the starting point of the record, I form : Proens $y^{\prime}$ in said support in order to retain the arm ut this pont. The framer y mas be mate of any desired material man-much as it hats me function in the reppeduction of armats, ber 120 ing merely ${ }^{10}$ safety device for prombing injury to the repronlucer puint. It is ar maged niljarent to the mandred in order to rentuce the beverage in shifting the min "hieh might mente in injory Io tho dian 125 pluagur.
 phonompont is sulstantially as follow-: The recond b lacing plated nijum the mamdel " und the mechanism rotating sat mandrel 130
and record being set in motion, the reproducer point $i$ is placed upon the right hand side of the record as shown in Fig. 2, in engalgement with the first of the indentations dentations or indicated sound wares thereon will set up ribrations in said point $i$ which vibrations will be transmitted to the arm $h$ along which they will pass to the inner end throw, whe $\cdot$ will be trons through the strand $j$ to the diaphragin $d$, the ribrations of which diaphragm will in the usual manner produce sound waves coinciding with those indicated upon the rec-隹 The point $i$ being firmly mounted upon and in intimate contact with the arm $h$, no cross ribrations will be caused by the movement of said point, and inasmuch as the arm $h$ is free from end to end from contact with any rigid matter, the vibrations will be uninterrupted and will be modified only by the material of this arm which will aid to modulate same in a manner to cause a rich, round, full reproduction of the sound cause the point to exert sufficient pressure upon the record to insure a responsive vibration to even the most minute rariance in the wave indication, thus insuring accuracy
30 in the slightest detail in the reproduction of sound from the record. The tensioning of the diaphragm $d$ will make this diaphragm extremely sensitive and cause it to pick up and respond to every slight vibration trans-
35 mitted through the arm $h$, thus carrying the accuracy and detail of the reproduction throughout the entire machine. The sharpness of the tone reproduced by the diaphragm $d$ may be governed by the tension ing said tension, I have found that the rel ume of the tone in increased, as well as its intensity, up to a certain point beyond which it increases merely in intensity. The use of
45 a strand $j$ made of wased cord produces the sweetest tones as, the elasticity of gut serves to deaden the tones somewhat, and the use of metal, to impart a metallic characteristic to the sound reproduction. The direction of
50 the pressures exerted by the springs $l n$ causes a substantially axial pull upon the diaphragm and causes the arm $h$ to rotate while traversing the record about an axis in alinement with the axis of the diaphragm or
55 sulstantially so, according to the pressure exerted by the spring $n$.

The reproducer point on the arm $h$ being in constant engagement with the indentations on the record, and all the strains on said arm said to rotate or move laterally under the control of the said indentations which lave a spiral trend so as to impart this movement.

It will be observed that the sound bor be-
ing stationary, is not subject to any vibrations whatever, excepting those transmitted to the diaphragm therein contained through the vibrator mechanism interposed between this diaphragm and the reproducer point and that thus the likelihood of external influence upon the diaphragm to create false ribrations thereof is reduced to a minimum. In fact the reproduced tones from my phonograph as herein described are entirely free from that scratching and those false blasts commonly found in phonographs, the elimination of which is one purpose of the inrention.

The outer end of the arm $h$ in following the record describes an arc as indicated in Fig. 3 of the drawings, but the fact that the reproducer point departs from the same radius throughout the record is immaterial, inasmuch as its engagement with the indentations is continuous and the reproducer point alone projects into said indentations and the outer end of the arm $h$ does not contact at any time with the record.

The operation of the adjustment mechanism is apparent. its function being solely to control the pressure exerted upon the diaphragm to place it in tension so as to secure the best quality of sound reproduction and eliminate any variance in the tension which might be due to the inequality of different springs in different machines.

The guide $q$ as heretofore stated, has no function in the reproduction of sound haring no operative engagement with the arm $h$ while it, said arm, is connected with the record. It is designed merely to prevent a careless operator from injuring the reproducer point or disturbing the adjustment of the machine.

The rarious connections between the springs, the arm $h$, the strand $j$, and the cross-head $c^{\prime}$ are made large in order to secure the desired swiveling action without loosely connected parts.

By placing a muffler upon the spring $l$ any ribrations which might otherwise be transmitted through said spring will be cut off, thus causing all vibrations to be concentrated within the diaphragm and these vibrations to be confined strictly to those of the ribrator mechanism interposed between the diaphragm and the reproducer point.
By the use of a close, straight-grain wood, I aroid blasts due to the material of the wood, and any cross ribrations therein, and thus cause such regular uninterrupted ribrations of the diaphragm $d$ itself as to secure a fine tone to the reproduced sounds.

The construction and arrangement of the fitting o not only directs the reproduced sound wares to the trumpet, but avoids loose parts at this point, while permitting the tones to be directed to any point about the sound opening or outlet $f$.

It is not my intention to limit the invention to the precise details of construction, shown in the drawings, it being apparent that my invention may be modified to adapt
5 it to any type of phonograph. I believe it to be broadly new to provide a sound box and its contained diaphragm having no movement whatever relative to the record and to transmit the sound waves to the rec-
10 ord, by means of a vibrator carrying a reproducer point adapted to engage the record and extended to and connected with the diaphragm in a manner to permit said vibrator member to traverse the record automatically,
15 and I intend to claim such broadly. I also believe it to be new to provide a diaphragm which is under tension aside from that being produced in setting the diaphragm in the sound box, and the action thereon of the
20 reproducer point and I also intend to claim such broadly.

Having described the invention, what I claim as new and desire to have protected by Letters Patent, is:-

1. In a phonograph, an amplifier, a flexible member attached thereto, means exerting a pressure upon said amplifier through said flexible member, whereby said amplifier is placed under constant direct tension, and
30 a vibrator member carrying a reproducing member attached to said flexible member.
2. In a phonograph, a diaphragm, means exerting a pressure on said diaphragin whercby said diaphragm is placed under 35 constant and direct tension and means transmitting sound vibrations to said diaphragm, said tensioning pressure being applied to said diaphragm in a direction opposite to the direction of movement of said sound 40 vibrations in passing to said diaphragm.
3. In a phonograph, a diaphragin, means exerting a pressmre centrally of said diaphragm, whereby said diaphragm is placed under constant and direct tension and means 45 transmitting sombl vilurations to said diaphragm, said tensioning pressure boing applied to said diaphragm in a direction opposite to the direction of movement of said somed vibuations in passing to said dia4. In a phonograph, a diaphragun, means exerting at pressme on said diaphatam whereby it is pataed under constant direct tension, a reproducer point, and vihator phragm wherehy the somed vibations resultmgry from the chigragement of said periut with indieated somud waves on a merord will be thasmitted from said point to said dint phagin! throngh satd yilnator memas, sald tensioning pressmre beiner upplied to anid diaphagra in ar direstion mpusite to Hra diredion of movenaent of snid somul vibrotions in puscing to said dimphragm.
means rotating the same, a sound box fixed relatively to said support and spaced away therefrom. a horizontally disposed diaphragm in said box, a ribrator member carrying a point adapted to engage and track in the indicated sound waves of a record, and extending in a direct line from said reproducer point to a point below said diaphragm, means forming a swivel connection between the end of said vibrator member and said diaphragm and means disposed out of the range of ribrations passing to said diaphragm, wherely said diaphragm and said connecting means are placed under tension.
4. In a phonograph, a diaphragm, a flexible member carried thereby and adapted to transmit vibrations thereto, means exerting a pressure upon said diaphragm through said member, whereby said diaphragın is placed under constant direct tension, a reproducer point, and a vibrator member between said point and said flexible member, whereby the vibrations resulting from the engagement of the said point with indicated sound waves on a record will be transmitted from said point to said diaphragm through said vibrator member and said flexible member.
5. In a phonograph, a diaphragm, a flexi-
ble member carried thereby and adapted to transmit ribrations theretn, means exerting a pressure upon said diaphragm through said member. Whereloy said diaphragm is placed under constant direct tension. a re- 100 producer point. a vibrator member between said point and said flexible member, whereby the vibrations resulting from the engagement of the said point with indicated somed waves on a record will be transmitted from 105 said point to said diaplragm throngh said ribrator member and said tlexible member: and means cansing said point to press upon said record.
6. T11 a phonograph, a diaphrngm, a tlexi- 110 ble momber carried rentrally thereot mad adapted to transmit ribrations thereto. means tensioning said member, a reprochuee point, a vibrator member between sulal point and in contact will sall flexible member wherely the vibutions resulting from the engugement of the said proint with the inti-
 mitter from said point to said diaphagen thromgatad vibator momber und sand the ih| member, and an clust in member liaviner onf cod sermend (on suld vibator member and
 fla $\times$ ible member wheroly sait llathe mem-
 ment uhout : commun als.

 trammit vibations thereto. In reprodacer prime, al viluther member hetwewn and puint
and said flexible member whereby the vibrations resulting from the engagement of the said point with indicated sound waves on a record will be transmitted from said point member and said flexible member, and elastic members extending from a fixed point directly opposite said flexible member to said flexible member and to said vibrator member respectively, whereby said diaphragm will be tensioned, and said vibrator nember will press said point upon said record, and said arm and said elastic members may rotate about a common axis.
7. In a phonograph, an amplifier, a flexible member attached thereto, means exerting a pressure upon said amplifier through said flexible member whereby said amplifier is placed under constant direct tension, 20 means whereby the tension of said amplifier may be varied, and a ribrator member carrying a reproducer member attached to said flexible member.
8. In a phonograph, a diaphragm, means whereby a pressure on said diaphragm, constant direct tension, means rarying said pressure to regulate said tension, and means transmitting sound ribrations to said dia30 phragm, said tensioning pressure being applied to said diaphragm in a direction opposite to the direction of morement of sound ribrations in passing to said diaphragm.
9. In a phonograph, a diaphragm, means phrag a pressure centrally of said diaunder constant direct tension, means rarying said pressure to regulate said tension, and means transmitting sound ribrations to said
40 diaphragm. said tensioning pressure being applied to said diaphragm in a direction opposite to the direction of morement of sound ribrations in passing to said diaphragm.
10. In a phonograph, a diaphragm, an elastic tensioning member acting centrally of said diaphragm, whereby said diaphragm is placed muder constant direct tension, means varying the tension of said elastic
50 member to rary the tension of said diaphragm, and means transmitting vibrations to said diaphragm, said tensioning means being applied in a direction opposite to the direction of movement of sound vibrations 5.5 in passing to said diaphragm.
11. In a phonograph, a diaphragm, an elastic tensioning member acting centrally of said diaphragm, whereloy said diaphragm is placed moder tension, means rarying the 60 tension of said elastic: member to rary the tension of said diaphragm, means transmitting vilrations to said diaphragm, said tensioning means being applied in a direction opposite to the direction of morement of
${ }^{65}$ somed vibrations in passing to said dia-
phragm, and means preventing vibrations in said tensioning member.
12. In a phonograph, a diaphragm, a flexible member carried thereby and adapted to transmit ribrations thereto, a spring acting through said flexible member to tension said diaphragm, a damper acting upon said spring, and means transmitting vibrations to said diaphragm through said flexible member.
13. In a phonograph, a diaphragm, a headed stud passing through said diaphragm with the head engaging same, a flexible looped cord suspended from said stud, a reproducer point, a ribrator member, the opposite ends of which respectively carry said point and are adapted to be attached to said cord, whereby the vibrations resulting from the engagement of said point with indicated sound waves on a record will be transmitted from said point to said diaphragm through said vibrator member and said cord, means carried by said arm whereby it may be attached to said cord, a spring secured to the attachment means between said arm and said cord, and acting axially of the center of said diaphragm and means causing said point to press upon said record.
14. In a phonograph, the combination of a mandrel, and means rotating same, of a sound box fixed relatively to said mandrel and at a point substantialiy tangential thereto, and substantially midway between the ends thereof, a vibrator member having a swiveling relation to said sound box and its diaphragm, and carrying a reproducer point adapted to engage the indentations in a cylindrical record whereby said ribrator member will more longitudinally of said cylindrical record through its engagement with the indentations thereon, elastic means forcing said reproducer point into engagement with the record and clastic means below the swivel connection exerting a constant direct pressure upon the diaphragm in said sound box.
15. In a phonograph, a fixed sound box, a diaphragm therein, a vibrator member one end of which is attached to said diaphragm by a swivel connection, and the other end of which is provided with a reproducer point whereby intermediate pivotal connections on said member are aroided, means intermediate the ends of said member whereby said reproducer point is forced into intimate relation with the record and elastic means acting at the other end of said member whereby said diaphragm is placed under constant direct tension, and the oscillations of said member will be about an axis at the end thereof adjacent to the diaphragm.
16. In a phonograph, a diaphragm, a member attached thereto, means exerting pressure upon said diaphragm through said member, whereby said diaphragm is placed
under constant direct tension, and a vibrator member, one end of which carries a reproducing member and the other end of which is engaged with said first named member.
5
17. In a phonograph, a diaphragm, a member attached thereto, a vibrator member one end of which loosely engages said member and the other end of which carries a reproducing member, and means exerting conto stantly uniform pressure upon said vibrator
member whereby said diaphragm is tensioned through said vibrator member and said first named member.

In witness whereof I have hereunto affixed my signature, this $23 d$ day of June, 1909, 15 in the presence of two witnesses.

CLINTON B. REPP.
Witnesses:
F. T. Wentworth,
P. Frank Sonnek.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
J. F. MEANS.

ELECTRIC BRAKE FOR GRAPHOPHONES.
APPLIOATION FILED APR. $10,1911$.
1,004,059.
Patented Sept. 26, 1911.
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2 SHEETS-SHEET 1.

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J. F. MEANS.

ELECTRIC BRAKE FOR GRAPHOPHONES.
APPLIOATION FILED APR. 10, 1911.
1,004,059.
Patented Sept. 26, 1911.
2 SHEETS-sHEET 3.


# UNITED STATES PATENT OFFICE. 

JOHN F. MEANS, OF OIL CITY, PENNSYLVANIA.

## ELECTRIC BRAKE FOR GRAPHOPHONES.

## To all whom it may concern:

Be it known that I, John F. Means, a citizen of the United States, residing at Oil City, in the county of Venango and State
5 of Pennsylvania, have invented certain new and useful Improvements in Electric Brakes for Graphophones; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable 10 others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in electric brakes for graphophones.

The principal object of the invention is
15 to provide an improved construction of electric brake mechanism for graphophones whereby the machine will be automatically stopped.

Another object is to provide means where-
20 by the circuit closing mechanism of the electric brake releasing mechanism may be adjusted to operate the brake when the needle has reached any desired point on the record.

With these and other objects in view the 25 invention consists of certain novel features of construction, combination and arrangement of parts as will be more fully described and particularly pointed ont in the appended claim.
解 1 is a plan view of a disk graphoplone showing the application of this invention; Fig. 2 is a vertical section taken on the line 2-2 of Fig. 1; Fig. 3 is a plan view partly
35 in section on an enlarged seale, of the magnet and brake releasing mechanism; Fig. 4 is a vertical section taken on line $4-4$ of Fig. 3 with the parts in retracted position; Fig. 5 is a similar view with the brake in
40 operative position; Fig. is is a from clevation with the casing removed; figg. 7 is an end elevation thereof; Fig. 8 is a detail cross sectional view through the lom showing the momating of the contad earried therebs.

In the embodiment illustruted, a cantrine 1 is shown in which is armagel the motor ame operating medmaism of the grapho phone. Above the entimet and revotably momed thereom is a lime table 2 om which
50 the record disks are arramged and operated. A horn supporting bracked is is preferably secmied to ono side of the catrinet now in somed transmitting horn $t$ is pivolully
mounted in the upper end of said bracket.
This horn 4 carries the reproducer 5 having 55 a record engaging needle 6 .
The parts above described may be of the usual or any desired construction and form no part of the present invention.
This improved brake mechanism com- 60 prises a brake cylinder 7 mounted in any suitable position on the cabinet adjacent to the edge of the turn table 2. A brake piston or plunger 8 is slidably mounted in the cylinder 7 carrying at its onter end a brake 6 . shoe 9 which is adapted to be forced into engagement with the edge of the turn talle for the purpose of stopping said table. This plunger or piston 8 is projected and held in operative position by a coiled spring 10 arranged around the rod or stem 11 of the piston within the casing as is shown clearly in Fig. 1. The onter end of the rod or stem 11 extends throngh and projects beyond the end of the cylinder 7 and has a motel 1 ? formed therein which when the phonger is $i_{1}$ a retracted or inoperative position is adapted to be engaged by a suitable catch which holds the phager in inoperative porsition. A pin $1: 3$ preferably extends at right angles from the stem il and projects throngh a longitndinally extending slot $i^{\prime}$ in the cylinder 7 the wall at the frome eme of the slot serving to limit the forward movement of the plunger and the ragne- 85 ment of the pin 13 with the side walls of the slot prevents rotation of the phanger. This pin 13 in connection with n lever 14 operates to retract the phager whon drsired. This lever 1.4 is prefermbly in the 9 lome of a bell-crank fulcommed the the eyt inder 7 wilh one arm extembel in paition (1) engage the pin $1: 3$ when the wher 1 mom thereof is depressed. I spring $1:$ is momet ad on the pintle of and engage the hare 11 (1) throw satil laver back ont of the wa! to permit the phanger to mown forwayl with out intermption when the stem theronf has
 ing stop for the pin when the ront in mivand. as will be herecina fle meme fulls demerimed.
The eatd herem show low holdane the
 linger th which projeds at riyht myghen from an nimature 18 which is held in phate 10\% by a sporing is in position to be uperated
by an electromagnet 19 which is arranged on top of the cabinet adjacent the cylinder 7.

On the cabinet adjacent the outer end of 5 the plunger rod 11 is a circuit breaker 20 , one member of which is in electrical connection with one pole of the magnet 19 by a suitable conducting wire 21 while the other member of said circuit is in electrical
10 comnection with a suitable battery 22 by a circuit conducting wire 23 . The battery 22 may be arranged in any suitable position but is shown secured to the side of the cabinet 1. With the other pole of the mag-
15 net is connected a current conducting wire 27 which runs to a contact switch hereinafter described. The other terminal of said switch is connected to the battery 22 by a current conducting wire 28 . When the operative position and the notch 12 thereof engaged by the stop finger 16 , the outer end of said plunger will engage the circuit breaker and close it.

The magnet 19 and the brake mechanism are inclosed in a suitable protective casing 33 having an opening 34 in one wall thereof through which the end of the lever 14 projects in position to be depressed by the oper-
30 ator for withdrawing the brake into inoperative position.

The circuit closing switch for the electromagnet as here shown preferably consists of a bracket 29 , secured to the top of the cabinet 1 on which is fulcrumed a bell crank lever 30, the terminal of the current conducting wire 28 being connected with said bracket 29 . The other terminal of the switch is in the form of a metal band 31
40 which encircles the horn 4 and has a contact point 32 secured between the ends of said band 31 and with which is connected the terminal of the current conducting wire 27 of the electromagnet. This contact 32 is
45 insulated from the band and projects into the path of one arm of the bell crank 30 which when it is desired to stop the machine will be swung into engagement with said contact 32 thereby completing the circuit to
50 the electromagnet and energizing said magnet, causing it to retract the armature 17. and disengage the finger 16 thereof from the notch 12 in the brake plunger rod, releasing said rod and permitting the spring 10
55 to force the brake shoe 9 into engagement with the turn table thereby stopping said table. When the plunger is thus projected.
the outer end of the plunger rod 11 will be disengaged from the circuit breaker, allowing the members thereof to again break the circuit to the magnet.

By the use of this improved brake and switch mechanism, it will be readily seen that the machine may be stopped at any desired place on the record.

While the brake and its operating mechanism has been herein shown as applied to a disk record machine, it will be understood that this application is simply shown for illustrative purposes as the switch may be readily applied to a cylinder machine and the brake mechanism thereon arranged to engage the record, mandrel or other moving part of the machine whereby the machine will be stopped.

From the foregoing description, taken in connection with the accompanying dratrings, the construction and operation of the inrention will be readily understood without requiring a more extended explanation.

Tarious changes in the form, proportion and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of the invention as defined in the ap- 8 pended claim.

I claim as my inrention:
A structure of the class described comprising a cabinet having a revoluble member thereon, a brake cylinder secured to said cabinet, a spring actuated plunger mounted in said cylinder and having a brake shoe adapted to contact with said revoluble member when in projected position, a projection on said plunger projecting through and guided by a slot in the brake cylinder, a bell crank lever arranged to engage said projection above the latter for retracting said plunger, a spring for normally holding said lever out of the path of said projection and forming a yielding stop for the latter when released, an armature arranged adjacent said brake cylinder and having a laterally extending finger for engagement with said plunger, magnets for actuating said armature, and a source of energy for energizing said magnets.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN F. MEANS.
Writnesses:
Abel L. Confer, Louis H. Kistler.
A. HEWITT.

SOUND AMPLIFIER.
APPLIOATION FILED APR. 14, 1908.
1,004,256.
Patented Sept. 26, 1911.


WITNESSES
Gir. Nactereane.
Strduick Q. Blowet

# UNITED STATES PATENT OFFICE. 

## ALBERTIS HEWITT, OF CAMDEN, NEW JERSEY, ASSIGNOR TO VICTOR TALKING MACHINE COMPANY, A CORPORATION OF NEW JERSEY.

## SOUND-AMPLIFIER.

1,004,256.
Specification of Letters Patent. Patented Sept. 26, 1911.

Application filed April 14, 1908. Serial No. 426,954.

To all whom it may concern:
Be it known that I, Albertis Hewitt, a citizen of the United States, and a resident of the city of Camden, State of New Jersey, have invented certain new and useful Improvements in Sound-Amplifiers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to sound amplifiers in general and more specifically to those used in talking machines.

The principal object of my invention is
15 to provide a sound amplifier by which the audibility of sound is increased and at the same time preserving its purity of tone and keeping it free from extraneous noises:

A further object of my inrention is to 20 provide a sound amplifier in which sound waves passing therethrough are first amplified and then concentrated at a predetermined position or line of concentration.

A firther object of my invention is to
25 provide a sound amplifier which also hats concentrating means and which may be readily inclosed in a talking machine calbinet or casing.

A further object of my invention is to 80 provide a somed amplifier constructed of a rigid and subbstantially non-vibratory material, thas permitting the somme waves to pass therethrongh withont beeng mingled with somnd waves herefofore cansed by viprevionsly used.

In my impored somed amplifior I hater also provided means wherely the sombls comitted are best andible at the line of eon-
 points of eppal radial distance from the bombth of the somed amplifies within the area extending in fromt of the plane of the momith of the lown.
 whem objents which will appent in the fol lowing sperification, my intrution consists in the constrowion, combination and arrangement of parts, stach as will be herein-
50 alter pointed ont in the chams malde here after.

Herdofore sommd amplifiers mad in com neetion with the reproduction of sommbe her taking machines hate been homs, comisal
55 or pyramidical in shupe, the smaller ctul lxe.
ing connected to a sound conreying tube which is attached to the sound box of the talking machine, and the sound wares reproduced by the sound box, passing through the said tube into the horn, issue therefrom at its larger and flaring end in their amplified form. It will, therefore be apparent that when the sound waves issue from the flaring mouth of the horn they are divergent, and are thus diffused into the surrounding atmosphere.
In my improved amplifier I have provided means whereby sound waves passing therethrough are first amplified and then concentrated at a predetermined position or line of concentration and when such predetermined position is withont the sound amplifier, instead of the somed waves issuing from the month of the horn in divergent directions they conserge as amplified, at the certain position or line of concentration. In this manner I have provided means for greatly increasing the audibility of the somols passing throngh a somend amplifier and have also provided means wherely the position or line of combentration may be fixed ats desired.

Referting to the accompanying drawing. in which similar reference charaters indicate like parts in the several ligures, Figume 1 is a pertiwal sectional view of my smmal amplifier and a suitulde incosing cabinet: Fig. Qa horizomal sedion of me improved somud amplifier and the indosing calvinet taken on the line: 2- of l゙ix. 1: and lig. : : is a perspective view of ay mentom.
1 is a reetangular cosing on cabine having a front 2 , back :3, sides I I, bothom is mat
 improwed somml amplitior io which is helil rigrid themen by the supmoting borks is



 Closing a mitathle motor upon tha -pimlle of "lich is momben a tumbulate 18. Smmel roproducing member pronded by the sultul hax it in which is mialaly momitarla




 sombl wase repronluced by the sumal lows. 110

The domnwardly extending elbor portion of the sound convering tube 15 is suitably piroted to the top 6 and is connected with the sound amplifier 7 through a hole 16 suitably prorided in the top 6. Mounted upon the top 6 of the cabinet is a casing 17 inclosing the turntable 13 and the reproducing parts of the talking machine. The top 18 of the casing 17 is hinged at 19 thereby 0 permitting easy access to the reproducing parts heretofore mentioned.

Means are provided for concentrating the amplified sound, such means being of course capable of rarious embodiments. In certain constructions, it is desirable to deflect the amplified sound before or during concentration. Means are provided, therefore, for this purpose, and in the particular embodiment which I have selected to illustrate my ${ }_{0}$ invention and which is shown in the accompanying dramings, the amplifier 7 has a front mall 20 , side and rear walls 21 and a deflecting surface 22 which is joined or made integral with the rear wall 21 at any desired 5 angle, although it is to be understood that the deflecting surface is not necessarily joined or made integral with the amplifier, but may in certain constructions be separated therefrom. The front wall 20 has an 0 offset 23 in close contact with the inner surface of the front 2 and the deflecting surface 22 terminates in an upwardly extending portion or lip 24 , which is also in close contact with the inner surface of the front 2 . sound amplifier substantially coincides with the opening 26 of the cabinet 1 and doors 27 are provided by which the opening 26 and at the same time the mouth 25 may be closed. ner of mounting the doors 27 whereby they may be completely opened or closed or occupy any intermediate position. I accomplish this by providing tracks 28 placed the opening 26 , 2 one on either side of adjacent door, the inward movement of which is determined by stop blocks 30 . Upon the doors $2 \overline{7}$ are mounted pins 31 tracks 28 . When the mouth 25 is opened by sliding the doors 27 the somnds issuing from the mouth may be deflected by arranging the doors in any desired positioni.

Indicated by dotted lines 32 are sound waves passing through the sound amplifier from the sound conreying tube. As these somud waves strike the deflecting surface 22 they are deflected at angles which may be may be constructed so that the deflected sound waves 33 will all pass through the month of the sound amplifier and the opening 26 of its cabinet in certain lines of direction which ultimately meet in a point $3 t$ or
a series of points forming a line. I term this line the line of concentration. It is obrious that by altering the deflecting surface 22 and the angle at which it is mounted the line of concentration may be determined as desired, either mithin or without the sound amplifier.

To prevent the mingling with the amplified sounds of secondary sounds caused by ribrations of the casing of the sound amplifier, I construct the casing of the sound amplifier of plaster-of-Paris, cement or some other suitable like material which is rigid and substantially inelastic and non-ribratory and I hare also found it desirable to make the interior of the casing smooth.

In the accompanying drawings and in the foregoing description I have shomn the application of my improved sound amplifier in an inclosing talking machine, cabinet or casing and connected to the reproducing parts of a talking machine, but do not limit myself to its use in that connection alone for it is obrious that it can be used in the ordinary talking machine with the sound amplifier mounted upon a suitable bracket or otherwise and extending upwardly and that it also can be used in any connection, the purpose of which is to amplify sounds.

Various changes could be made in the details of the construction, combination and arrangement of my improved sound amplifier illustrated, without departing from the spirit and scope of my inrention.

Having thus fully described my invention, I claim and desire to protect by Letters Patent of the United States:-

1. A sound amplifying horn haring its outer end closed and prorided with a lateral outlet, and having a focusing surface, arranged to directly reflect all wares convergingly through said outlet toward a line.
2. A sound amplifying horn prorided with means for concentrating the sound wares substantially along a line.
3. A sound amplifying horn comprising a conical portion and prorided with a restricted outlet in one side thereof, and means closing the end of said conical portion for directly reflecting all of the sound wares through said outlet in planes converging toward a common line.
4. A sound amplifying horn comprising a conical portion and provided with an outlet on one side thereof, and means closing the end of said conical portion for reflecting the sound wares through said outlet and concentrating the same in planes meeting in a line.
$\breve{5}$ : A sound amplifying horn comprising a 125 conical portion and provided with an outlet in one side thereof, and means closing the end of said conical portion for reflecting the sound wares through said outlet and concentrating the same along a transrerse line. 133
5. A sound amplifying horn comprising a flat conical portion having a closed outer end and provided with an outlet on its flat side adjacent to said end, said end being se 5 constructed as to reflect the sound waves through said opening and concentrate the same in a line.
6. A sound amplifier comprising a horn provided with a lateral opening in one side 10 thereof and formed of a substantially nonvibratory material, arranged to direct all sound waves through said opening and convergently toward a line.
7. A sound amplifier comprising a horn 15 provided with a lateral opening in one side thereof and formed of a substantially inelastic material, arranged to direct all sound waves through said opening and convergently toward a line.
8. A sound amplifier having a lateral outlet, and provided with a cylindrically curved end closure arranged to reflect sound waves
through said outlet and concentrate said waves to meet in a transrerse line.
9. A sound amplifier having a substan- 25 tially D-shaped cross section increasing toward its outlet end, and having a lateral outlet adjacent to said end and provided with a curved closure extending across said end arranged to reflect sound waves through 30 said outlet and concentrate them along a transverse focal line.
10. A sound amplifier, having a lateral outlet registerable with a cabinet aperture and provided with a rigid end closure ar- 35 ranged to reflect sound wares through said outlet and concentrate said wares to meet in a line.

In witness whereof I have hereunto set my hand this 13th day of April, A. D. 1908. 40

ALBERTIS HEVITT.

## Witnesses:

Fredi. C. Eberhardt, Frederici A. Blount.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
J. H. J. HAINES.

PHONOGRAPH.
1,005,025.

Patented Oct. 3, 1911.
2 SHEETB-SHEET 1.

Fig. 1.


Fig. 2.


Fíg. 1.


Q Vitnesses:
Naldo Mn blatine

J. H. J. HAINES.

PHONOGRAPH.
APPLICATION FILED DEC. 23, 1908.
1,005,025.
Patented 0ct. 3, 1911.
2 SHEETS-SHEET 2.


Fig.7.


23itnesses:
Tauns.Obun
Maldo Mobhafin


# UNITED STATES PATENT OFFICE. 

JOFIN H. J. HAINES, OF NEW YORK, N. Y.

PHONOGRAPH.
1,005,025.
Specification of Letters Patent. Patented Oct. 3, 1911.
Application filed December 23, 1908. Serial No. 468;892.

## To all whom it may concern:

Be it known that I, Jorin H. J. Haines, a citizen of the United States, residing at the city of New York, in the borough of 5 Manhattan and State of New York, have invented certain new and useful Improvements in Phonographs, of which the following is a full, clear, and exact description.

This invention relates to phonograplis and 10 allied machines and has for its object to facilitate the remoral of the record tablet from the machine and avoid injury of the same in that operation.

The invention relates particularly to ma-
15 chines using a record tablet of the cylinder type. These cylinder's are applied to the machine by passing them over a slightly coned drum or mandrel on which they are held by friction In order to remove the 20 cylinder from the machine, it has heretofore been necessary to grasp the cylinder between the fingers and exert sufficient force to overcome its frictional engagement with the drum. This is an unhandy method of manipulation and often results iu damage to the record surface by reason of the pressure of the fingers thereon, or by transference of dust or dirt from the fingers to the record. Also, if the record sticks tight!y upon the 30 drum, the force used in removing it sometimes canses it to suddenly rolax and the cylinder falls from the hand and is broken.

To avoid these disadrantages and such others as often wecur in the removal of the
35 cylinder from the machine, is the object of my invention, which consists in providing the machine with what I have fermed at "throw-of" or ejector comprising a philier momed in the firme of the madhene in a
40 pusition where it can be brought to beerr against the imere ond of the record eylinder in a direction parallel to the axis of the cylimere, and a mamailly yperated hathlle or lever emmeded therewith in sum : mammer
45 that bey manipulating the hamdla or Inere the pusher may be thust against the rud of the perome eylinder forme from its surpporting drom on mamerel. The movernent


 with the drmun on manderl, so that it "an be rambly remosed by hand and withont the exercise of forme.
Thos invention is mphicable fo shan ving nur
surface of a record cylinder and preparing it to receive a new record, since these machines comprise a drum or mandrel upon which the record cylinder is held in substantially the same mamer as it is in the phonograph itself.
The invention is illustrated in the accompanying drawings, in whech:

Figure 1 is a side elevation partially in section, of a portion of a phonograph or shaving machine upon which the record cylinder is momed; Fig. 2 is a section on line $x$ - $x$ of Fig. 1; Fig. 3 is a perspective viow of the specific device comprising the invention; Fig. $t$ is a similar vien of a modification thereof; Fig. 5 is a view similar to Fig. 1, showing an alternative form of the invention; Fig. 6 is a section on line $y$ - $y$ of Fig. 5 , and Fig. $\tau$ is an end eleration of the structure of Fig. o.

1 indicates a portion of the frame of a phonograph or record shaving machine. in which is momed a rotary shaf fi 2 haring a driving pulley 3 and carrying the usinal coned drom or mandrel 4 npon which the record क) in the form of a cylinder is supported while in use. The record cerlinder is coned interiorly io tit the surface of mamelvel t, so that when it is adjusted mpon the mandrel and foreed thereon slighty. it is hedd frictionally from independent monement with respect to the mander
Monnted in a suitable part of the frame so as to slide therem is a rot or pusher of having a head 5 arranged at a perint clowell. adjacent to the imer end of the rewod wiinder when it is properly adjusted upm ine mundred. This pusher hats a lomgitudimat movement substantially parallel to the a do of the mandrel and eximer and is mbpland (1) be foreed agatinat the emal of the ev linder to arerome the frictional ehgagement leween it mad the mandrel. In order to the complish this morememt, there is pron ided a rank urmis whese outer emblamis in :a notsh! in the pashertiwhite the where cond is
 ing in llor fromel, whl whind is equipped at its ather emb with 11 hamile or lener 11 in combenient reach of the operator. I ato provide $n$ spring 10 sermod at one cond (1) the froma and at the where emd to the pushere G. the function of 11 hich is to rethen H1e prisher ufter it has hesen moned in ome disection lye the had lerer. It is now ah. vions that ishen it is desired to relemes tha




$\square$

so




$\qquad$ chanes, commonly used for tmoning ofl the
record cylinder from the conical mandrel, it is only necessary to swing the lever 11 to the right, which drives the head of the pusher against the end of the cylinder and 5 forces it sufficiently to the right to overcome its frictional engagement with the mandrel, whereupon by passing the fingers into the right hand end of the cylinder in the customary manner, the record is rehout having touched any portion of its outer surface. As soon as the hand lever is released, it mores back to its normal position together with the pusher under the action of the
15 spring 12. Obriously, howerer, the spring is not an essential part of the invention, since the hand lever and pusher might be left in the position to the right and be returned to the normal position by the impact of the justed to the mandrel.

As a modification of the manner of communicating movement to the pusher rod from the handle, I have shomn in Fig. 4 that the rod may be provided with a rack 13 and the crank 8 provided with a gear segment 14. This will gire a more uniform application of pressure upon the pusher When it is manipulated and can be made to
30 increase the length of the thrust of the pusher if that is fomed to be desirable.

The altemative form shown in Figs. 5 to 7 , inclusive, comprises a number of rods 15 arranged longitudinally inside of the mandrel near to its walls and mounted in suitable bearings so as to slide in a direction parallel to the axis of the mandrel. At the outer or riglit hand end of the mandrel these rods are all connected together by a common knob or handle 17 by which all of the rods can be together puilled outward. At the inner or left hand end of the rods they are each equipped with a pusher head 18 which extends radially outward through slots 19 in the wall of the mandrel and leading backward any suitable distance beyond the inner end of the record cylinder when it is properly adjusted to the mandrel. Betreen
50 the pusher lieads 18 and one of the bearings of the rods 15 , springs 20 are interposed for returning the pusher heads to their normal position after they have been operated manually to relcase the record crlinder from
55 the mandrel. The operation of this alternative construction obviously is that by pulling on the knob 17 the pusher heads 18 are
driven against the end of the record cylinder and thereby forced from its frictional engagement with the mandrel, the pusher heads meanmhile sliding through the slots in the wall of the mandrel. On the release of the knob the springs carry the pushers back to their normal position. This construction possesses an adrantage orer the construction first described in that it is adapted for different lengths of record cylinders, or to record cylinders which occupy various positions along the length of the mandrel. By making the slots 19 of sufficient length, any morement of the pusher heads that mar be necessary to reach and move the record cylinder may thus be prorided for.

Haring dewcribed my invention, I claim:-75

1. In a phonographic machine, the combination of a recessed conical holder for the record tablet, said holder haring a longitudinally extending slot therein at the larger end thereof, with means for pulling the record longitudinally orer said holder, said means comprising a structure adapted to be placed under tension and morable through the recess of said holder. said structure haring an angularly disposed part morable throngh said slot and adapted for engagement with the end of the record tablet which is carried by the larger end of the holder, said structure further comprising a handle at its outer extremity, whereby it may be placed under tension.
2. In a phonographic machine the combination of a recessed conical holder for the record tablet. said holder haring a longitudinally extending slot therein at the larger end thereof, with pulling means for shifting the record longitudinally over said holder, and means for guiding said pulling means. said pulling means comprising a structure adapted to be placed under tension and guidedly morable through the recess of said holder, said structure haring an angularly disposed part movable through said slot and adapted for engagement with the end of the record tablet which is carried by the larger end of the holder, said structure further comprising a handle at its outer extremity.

In witness whereof, I subscribe my signature, in the presence of two witnesses.

## JOHN H. J. HANNES.

## Witnesses:

Waldo M. Cihapin,
Janies D. Antonio.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
W. G. ALTENBURGH.

AUTOMATIC CUTOFF AND STOP FOR SOUND REPRODUCING MACHINES.
APPLICATION FILED MAY $3,1909$.

## 1,006,517.

Patented Oct. 24, 1911.


# UNITED STATES PATENT OFFICE. 

WILFORD G. ALTENBURGH, OF NATIONAL CITY, CALIFORNIA.
AUTOMATIC CUT-OFF AND STOP FOR SOUND-REPRODUCING MACHINES.
$1,006,51 \%$.
Specification of Letters Patent. Patented Oct. 24, 1911.
Application filed May 3, 1909. Serial No. 493,755.

## To all whom it may concern:

Be it known that I, Wilford G. Altenburgir, a citizen of the United States, residing at National City, in the county of San Diego and State of California, have inrented certain new and useful Improvements in Automatic Cut-Offis and Stops for Sound-Reproducing Machines, of which the following is a specification.

My invention relates to an improred automatic cutoff and stop for sound reproducing machines and is more particularly adapted to machines using the disk record.

The objects are: to provide a simple, heap, sate, and positive means for automatically raising the needle and stopping the machine at the end of the record, or at any predetermined point when desired. Further, it is adjustable to different records and it is adaptable to the different makes of machines now in use and may be used therewith.

The nses and advantages of my invention will be readily apparent from the following companying drawings, in which:-

Figure 1 is a partial perspective view of a sonnd reproducing mechanism and showing my antomatic cutofl and stop) complete yew theremith. Mig. - is an cheraponal view of part of my device assembled: Fig. 3 is a top view thereof: Fig. 4 is a side elevation partially (lisassembled: Fig. is is a (m) view increof: Fig. (is is a plan and side elera-
35 tion of a leather washer 40 : Fig. 7 is a side and plan view of thmb mint 38 : Figs.s. 8 and (3) are side views of spindle :32., The one franserse to the other: Fig. 10 is at side and han view of the upper arm (lamp 3.5: Fig. (lame 41 : Figg. 12 is a side and plan view of a catch device: Pigg 1:3 is a side view of as




Similar chatacters of refermee refor 10 similar parts thomghom the semond views.

My devier is rompused of a wo assomblad purts, whe wh which is wltached to the rem-
 marlime.

1 reperesimts the sumal bex with the mer.
 odinury syle.

Around the sound tube 3 and adjacent to the sound box 1 is placed a clamp 5 ardapted to be clamped tightly thereon by means of screw 7. One portion of said clamp is extended and formed into a slort turn at (i then backward nuler said sound tube 3. thu:producing an inclined tongue 8 adjacent to said bend 6. Scretred into both members and extending downward, is stop pin 9.

In the central vertical post 42 of the machine, I have provided a central hole and near its top have extended the sides of said hole so as to fit the spindle :32 and pin $3: 3$ therein. This keeps the spindle 32 from turning after its insertion into said rertical post t2. Over spindle 3:2 and pin 33 is placed an arm clamp 41 shaped as shown at $41^{a}$, to fit the pin 33, and it sets a wainst the shoulder 31 of the spindle 32 and rests upon the top of the central post to. Above said arm (lamp 41 is placed another arm (lamp) 3.5 mpon said spindle $33_{2}$, with an extembed portion 36 which extends. npward and in the fower side is provided with slot $3 t^{\text {n }}$ adapted to fit over pin 34 which extembe formogh spindle $3: 2$ and guthes the upper arm clamp 3.7. The toperel of said spindle is prowided with a thesend 30 (on whicle thumb mint 38 is adapted to serew. The protion 3 Bextends downward adjacent to pertion Bti。Oper portions 36 and 37 a (empression spring 3 ! is placed, for the purpose of kecping a slight tension on the upper arm danp 3.5, when the (lumb mit 3 sis is relesisel, fur anljutine
 and 11. (On satil spindle 332 is platod and. justiner arm 20 and washers - 10 . (mas ond wich side, for the purpme of hinding the anm :10)

 Hithe wider than the spindte 32.2 :and mbapten


 on the lower cmit of which, is pon ibled an

 in pusition ly mans of screw :2. \romml
 "hich is ant dewn ont its ome side. whe the shonhlars thereof wel ut stops for "1 pin 13 which is ad in ontch If. It can remdily he

 then serting the needle in the mad of the record gromis, with int 88 released muld ant
ting point 10 of the catch in bend 6 of the clamp, then tightening thumb nut 38 and starting the machine as usual, when point 10 slightly touches the inside of bend 6 it
5 will move it sufficiently to throw the eccentric 18 over the center, which gives the spring 26 a chance to expand, the catch 14 will be thrown around, one half turn, until pin 12 strikes shoulder 24 ,-in the position 10 shown in Figs. 4 and 5,--and when the machine comes around again, the curve 13 on catch 14 will come in contact with tongue 8, thus gradually raising the needle and later striking catch pin 9 which stops the machine.
Haring thus described my invention, what I claim and desire to secure by Letters Patent is:-

1. A talking machine comprising a rotative record disk and a reproducer movable adjustable radially of said disk, to rotate therewith and means including an inclined member mounted upon said reproducer and operative to interlock with said catch to disk, all substantially as set forth.
2. In a sound reproducing machine, the combination of a center post, a spindle set rertically in a hole in said center post, an
30 arm provided with a slot and mounted upon said spindle, a pin on said spindle to prevent its turning relatively to the post, clamps on said spindle on each side of said arm, means for tightening said clamps, a stud set
35 on the extended end of said arm, a catch mounted thereon, said stud being provided with an eccentric for turning said catch onehalf turn, means for stopping said catch at each end of the one-half turn, a sound tube, tube, sound tube, an extended normally inclined tongue in connection with said clamp, and a pin on said tongue, said tongue and pin being adapted to operate in connection with said catch chine, all substantially as set forth.
3. In a sound reproducing machine, the combination of a center post, a spindle provided with a pin to prevent its turning set
50 in said center post, an arm provided with a
slot and mounted upon said spindle, clamps on said spindle on each side of said arm, a thumb nut scremed on the top end of said spindle for tightening said clamps, a spring to provide slight tension on the clamp at all times, a catch mounted on a stud set in the extended end of said arm, said stud being prorided with an eccentric for turning said catch one-half turn, spring means for operating said eccentric, a bushing with shoulders for stopping said catch at each end of the one-half turn, a sound tube, a clamp adjustably mounted on said sound tube, an extended normally inclined tongue in connection with said clamp and a pin on said tongue, said tongue and pin being adapted to operate in connection with said catch to raise the needle and then stop the machine, all substantially as set forth.
4. In a sound reproducing machine, a 70 mechanism for raising the needle and later stopping the machine, comprising, a sound tube, an inclined tongue on said tube, a center post, a vertical spindle set into a hole in said center post, means for preventing its turning therein, a slidable arm provided with an adjusting slot on said spindle, clamps provided with washers on their faces for holding said arm in its adjusted position, a nut on the top end of said spindle for tightening said clamps, a tension spring adapted to provide tension on said clamp for the purpose of holding said arm in position when the nut is released, a vertical stud on said arm, an eccentric on said stud, spring means for operating said eccentric, a catch adapted to operate in connection with said inclined tongue, a bushing provided with shoulders adapted for stopping said catch mounted on said arm, a pin in said tongue and clamp means for attaching said pin and said tongue to said sound tube, all substantially as set forth.

In testimony whereof I have hereunto set my hand in presence of two subscribing wit- 95 nesses.

WILFORD G. ALTENBURGH.
Witnesses:
Ernest L. Bullen,
Guy A. Raymond.

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1,005125
$$

H. B. BABSON \& A. HAUG.

TALKING MACEINE.
$1,005,765$.

$$
\text { APPLIOATION FILED FEB. 11, 1909. RENEWED MAB. 4, } 1911 .
$$

Patented Oct. 10, 1911.


## UNITED STATES PATENT OFFLCE.

HENRY B. BABSON AND ANDREW HAUG, OF NEW YORK, N. Y., ASSIGNORS. BY MESNE ASSIGNMENTS, TO VICTOR TALKING TVATINE COMPANY, A CORPORATION OF NEW JERSEY.<br>TALKING-MACHINE.

## 1,005, \%65.

Specification of Letters Patent. I'alented Ort. 10, 19)11.
Original application filed May 7, 1905, Serial No. 248.872. Livided and this applic?tion filed Febreary 11 , 1909, Serial No. 477,323. Renewed March 4, 1911. Serial No. 612404

## To all whom it may concern:

Be it known that we, Henhy B. Babson and Nrmmew Hacfi, citizens of the United States, both residing at New York, county
5 and State of New lork, have invented certain new and nsefnl Improvements in Talk-ing-Machines, of which the following is a specification.

Our invention relates gencrally to talk-
10 ing machines and particularly to means for yieldingly supporting the reproducer above and clear of the record when the machine is but in nse or while ane recored is leeines sul)stituted for anothere this application being a dr-
15 vision of onn application Serial No. 248.8T2.
A device suitable for carrsing our invention inter effect is illustrated in the accompanying drawings. We wish it understord. however, that we do not limit ourselves to
20 either the exact construction or arrangement of parts shown, as various changes may be made therein without departing from the spirit and scope of our invention.

In the drawing-Fignre 1 is a view in
25 side elevation, partly in section, illustrating the application of our invention to a well known disk type of talking marline, and Fig. 2 is a sectional view taken on the line $s^{2}$. $s^{2}$. of Fig. 1.
30 Reforring now to the drawings, 1 repreeents the casing of the machine. 2 the rotating table themen which corvers as a support for the recerra 3. Seecured to the calsing loy serews 4. the is a bracket arm $\therefore$.
35 provided with a sleme like afl-we (i) in which the smath end of the lomen 7 nad the shaped curl of the taper arm \& are fitten in the nsmal mamer. It the outere fiee end of the taper arm. the somed bex or repere-
40 duree! ! is secered. The hateket sterese fis shotted at diamedrically opposite poinks as indieaterl at 10, toreeceivestmbe, pinse serems or the like 11. Which serve (on suppert the (ap) arem in smpended relation in the
45 slecere in a manner to permit free perdient sull lorizontal monement therenf.

When the mardine is mot in me on during
 for : another, it is rastommer for sine the
 lines and in onder for ydulingly maintain it in such pusitions, "re employ an suimblu locking devire, which is : momberl to of
operate with the taper arm, as shown in Fig. 1. The lurking device, as herein emborlied. operates on the well known principle of a pair of toggle lever.. one of which is formed by the ellow 12 of the taper arm and turns about the eenter 11 and the other, by the link 13, piroted to the ellow at 14 and toming about the center 1.5. As arrangel. it will he seen that when the reproducer is in contact with the record, as representerl in full line-, the pirot pin 14 will be slifted to the left of the line of ernters indicated at 16 and when swnig upward, the piset pin will be rarried arroce. th the oppoxite side thereof, as represented in dotterl lines.
The backet arm is bored ont as indicaterl at 17, to perecive a headed pin 15 , to the !upere projecting curd of which the link $1: 3$ is pionterl. A syming 19, interposed loptween the lower end of the pin amblate -ion serew 20. act- throngly the pin to mamtain the pirme 14 either to the right or left of the line of renters, depending men the position of the reprochurer and at the same time. yield- as regmired. to permit the piom 11 to swing acres the line. an the reprore so dureer is miserd or lowered.

From the foregoing it will be sem, that when the reppentucer is swime npward, the apring roacting with the togragle locking devire will vicklingly : vated pontion and on lowntiner the remo Where. the adion of the -pring will bere-



 wrew cillaer to thr right or loft.
 fime wo.. of the lewher levion is mimpor


 surilual.
 fime wn (1nim:






2. In a talking machine, the combination of a rotating record, a coöperating reproducer, a spring opposing morement of the reproducer away from the record, means for reproducer is swung clear of the record, and means for varying the tension of the spring.
3. In a talking machine, the combination of a rotating record, a coöperating repro- reproducer away from the record, and means for utilizing the spring as a yielding support for the reproducer when swung clear of the record.
4. In a talking machine, the combination of a rotating record, a coöperating reproducer, and a spring acting to yieldingly maintain the reproducer in both operative and inoperative positions relative to the record.
5. In a talking machine, the combination of a rotating record, a coöperating reproducer, a spring acting to yieldingly maintain the reproducer in contact with the record, and means for reversing the action of the spring when the reproducer is swing clear of the record.
6. In a talking machine, the combination of a rotating record, a coöperating reproducer, a pin about which the reproducer turns as a center, and a spring acting through the pin upon the reprodncer to yieldingly maintain it in both operative and inoperative positions.
7. In a talking machine, the combination of a rotating record, a coopperating reproducer, a spring pin about which the reproGlucer turns as an axis, and means forming a toggle connection between the pin and the reproducer.
8. In a talking machine, the combination of a rotating record, a coöperating reproducer, a spring, and a toggle connection through which the spring acts upon the reproducer.
9. In a talking machine, the combination
of a rotating record, a coöperating reproducer, a member morable with the reproducer, a spring opposing movement of said member, and a toggle joint connecting the 50 member and the reprodncer.
10. In a talking machine, the combination of a rotating record, a coöperating reproducer mounted to swing about a rertical axis, and toggle levers operatively connected with the reproducer in the line of its axis.
11. In a talking machine, the combination of a rotating record, a coöperating reprodncer mounted to turn upon a rertical support, and toggle members forming part of 6 said support.
12. In a talking machine, the combination of a rotating record, a coöperating reproducer mounted free to swing in planes parallel and at right angles to the surface of the record, and means interposed to form a toggle joint between a fixed point and one of the turning axes of the reprodncer.
13. In a talking machine, the combination of a rotating record, a coöperating reprodncer mounted free to swing in planes parallel and at right angles to the surface of the record, a spring, and interposed means forming a toggle joint between the spring and one of the turning axes of the reproducer.
14. In a talking machine, the combination of a rotating record, a coöperating reproducer monnted free to swing in planes parallel and at right angles to the surface of the record, a vielding member. and means interposed in the line of one turning axis of the reproducer to form a toggle joint between the other turning axis thereof and said yielding member.

In testimony whereof, we affix our signa- 85 tures, in the presence of two witnesses.

> IENRY B. BABSON.
> ANDREW HAUG.

Witnesses:
S. L. Macoubrey,
M. G. Crattrord.
W. H. PUMPHREY.
talking machine.
1,006,128.


# UNITED STATES PATENT OFFICE. 

## WALTER H. PUMPHREY, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN GRAPHOPHONE CO., OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF WEST VIRGINIA.

TALKING-MACHINE.

## 1,006,128.

## Specification of Letters Patent. Patented Oct. 1\%, 1911.

 Application filed December 3, 1906. Serial No. 346,026.
## To all whom it may concern:

Be it known that I, Waliter H. Pumpiriey, a citizen of the United States, residing at New York city, borough of Man5 hattan, in the county and State of New York, have invented certain new and useful Improvements in Talking-Machines, of which the following is a specification.
My invention relates generally to talking 10 machines and particularly to means for automatically controlling the rotating table or support which carries the record.
The object of the invention is to do away with the hand-operated brake now com-
15 monly employed in talking machines and cause the rotation of the record supporting table to be automatically controlled by the sound-box or reproducer, which, in being lowered into engagement with the record or
20 swung upward clear of the same, actmates a suitable brake device in a manner to limit the rotation of the record supporting table to periods when the reproducer is in contact with the record.
25 A further object is to ntilize the brake as a means of yieldingly supporting the soundbox in the position it usually occupies above and clear of the record when the machine is not in operation or while one record is 30 being substituted for another.

Mechanism suitable for carrying my inrention into effert is illastrated in the accompanying drawings. I do not wish to be minderstond, however, as limiting myself to
35 either the exact form or arrangement of parts shown, as varions changes may be made therein withont departing from the spiril and scope of my invention.

In the drawings Figure 1 is a side eleration, partly in section, of a lalking machine of a well kown type, showing my incention applied. Fig. 2 is a detail eross section on the lime $x^{2}$, $x^{2}$, of Fig. I. Figg. :3 is a similar view on the lime $s^{3}, s^{3}$, of Fig. 1 . R.: of Fig. .t, and Fig. 5 is a like riew on the line $s^{5}, s^{5}$, of Fig. I.

Referting now to the dratwing. 1 tepme semts the emsing of the mathine. 2 the ro50 anting table oft which the record 3 is supperterl, 1 a hracket seemed to thereming and provided with urertimally disprasd slener like off-set 5 . to reerefe the stmull emt of the horn fi and the shaped elad of the tupered 55 nrm or somud conveying tuhe 7. The sleeve
is slotted upon opposite sides as indicated at 8 and projecting into the slots, there are oppositely disposed screws or sturls 9 , which serve to secure the taper arm in position and support the same free to swing vertically and horizotitally. At the outer end of the arm 7, a sound-box 10 is mounted in the usual manner to coöperate with the record carried by the rotating table above referred to, the arm 7 and sound-box 10 forming the 65 reproducer.

The construction thus far described is that found in machines now in general lise and forms no part of the present invention, being here employed for purposes of illustration only and it will be understood that the invention is not limited in its use to the particular type of machine shown.
Pivotally mounted upon a cross pin 11 of the bracket 4 , there is a brake-arm 12, the free end of which is recessed to receive a piece of felt or other material suitable for frictionally engaging the edge of the rotating table.

Under the action of twin springs. 13, ar- so ranged one on each side of the arm 12 , an shown in Fig. 3, the brake is yieldingly held either in or out of engagement with the table. The springs ate secured at their lower euds to a cross pin 11, fixed direedly below the pisot pin and have their upper ends hooked over studs lis of the brake-n rm. the arrangement being such that ass thre brake-arm is moved far cmang in cither direction to carry the studs wior the pibotal ? center, the springs and to rontime the mowement and snap the brake furwame into ern gagement with the table on bel lwara agains a stop 1 i , depending : 1 pern the direstion of the initial menement imparted the same.
 bell-crank 18 und pias 1:? Whe the ellow of the taper wrom und thas arranged, it will be secol thut us the sumbl-lios is lifterl from the

 giving it mevemont formind tomatil the table matil the state th pase ander phental
 complete the morement whd yidding!s minin tain the hruke uppliend.

It will be mbertord, that when the brenke is thentw on us just deseribed, the return of the somend tox is oppored bye the brake springs und us a ramelt, the simmel bex is 11
yieldingly held by the same in an elevated position, thus dispensing with a separate locking derice such as is ordinarily employed for this purpose.
an an wate, it is only-neces ar ward the record and the required motion will be imparted to cause the brake-arm to swing amay from the table until the springs

A pin and slot connection indicated at 20 , is preferably employed between the bellcrank and the link 17, in order to produce sufficient lost motion to enable the brake to 15 be thrown on or off at any desired point in the rertical morement of the sound-box. The pin 19 is connected to the taper arm by a universal joint indicated at 21 , which permits the arm to more freely both rertically
and horizontally as required.
In adapting the device to other types of talking machines, the connection between the taper arm and the brake may be changed in any manner desired or the brake may be the motor other than the rotating table or other changes may be made in the construction shown within the meaning of the present inrention. the essential feature of which tion, I claim:

1. In a talking machine, the combination of a rotatable support for a record. a soundbox mounted in operative relation thereto. a brake coöperating with the record support. and a connection through which motion of the sound-box in planes at right angles to the surface of the record is transmitted to the brake.
2. In a talking machine, the combination is the automatic control of the brake by the sound-box. the resulting adrantages of Which will be apparent from the foregoing description.
f a rotatable support for a record, a soundbox mounted in operative relation thereto, a brake coöperating with the record support. and a connection through which motion of the sound-box toward and from the record is transmitted to the brake.
3. In a talking machine the combination of a rotatable support for a record. a soundbox mounted in operative relation thereto, and means actrated by the rertical morement of the sound-box for controlling the rotation of the support.
4. In a talking machine. the combination of a rotatable record, a coöperating sound reproducer. and means responsive only to morement of the sound reproducer other than that imparted to it by the record, for automatically timing the periods of rotation of the record.
5. In a talking machine the combination of a rotatable record, a coöperating sound
reproducer, and automatic means controlled by the somnd reproducer for limiting the rotation of the record to periods when the sound reproducer is in engagement therewith.
6. In a talking machine, the combination of a rotatable record supporting table, a sound-box mounted to hare morement in rertical and horizontal planes, a brake controlling the rotation of the record supporting table. and a connection through which motion of the sound-box in a rertical plane is transmitted to the brake.
7. In a talking machine, the combination of a rotatable record supporting table, a sound-box mounted to have morement in planes at right angles to each other, a brake controlling the rotation of the record supporting table, and a connection through which motion of the sound-box toward the table is transmitted to throw off the brake.
8. In a talking machine, the combination of a rotatable record supporting table, a sound-box mounted to hare movement in planes at right angles to each other, a brake controlling the rotation of the record supporting table, and a connection through which motion of the sound-box away from the table is transmitted to apply the brake.
9. In a talking machine, the combination of a rotatable record supporting table, a sound-box mounted to have movement in planes at right angles to each other, a brake controlling rotation of the record supporting table, and a connection through which motion of the sound-box toward and from the table is transmitted to throw the brake off and on.
10. In a talking machine, the combination of a rotating record supporting table, a cooperating sound-box, and a brake for the table responsive to morement of the soundbox toward and from the table and acting when applied, to maintain the sound-box clear of the record.
11. In a talking machine, the combination of a rotatable record supporting table, a cooperating sound-box, and a brake for the table released by morement of the soundbox away from the table and acting when applied, to maintain the sound-box clear of the record.
12. In a talking machine, the combination of a rotatable record supporting table, a cooperating sound-box, and an automatic brake for the table, the application of which antomatically follows the movement of the sound-box clear of the record and yieldingly opposes the return thereof.
13. In a talking machine, the combination of a rotating record-supporting table, a cooperating sound reproducer, a table brake, and a spring common to the sound reproducer and the brake, acting to yieldingly hold the brake clear of the table when the11115
sound reproducer is in engagement with the record.
14. In a talking machine, the combination of a rotatable record supporting table, a co-
5 operating sound-box, a table brake, and a spring controlled by the sound-box in moving the brake in and out of engagement with the table.
15. In a talking machine, the combination rotatable record supporting table, a cooperating sound-box, a table brake, a spring co-acting with both the sound-box and brake, and a loose connection through which the spring is controlled by the sound-box.
15
16. In a talking machine, the combination of a rotatable record supporting table, a cooperating sound-box, a table brake, a spring common to the sound-box and brake acting
to hold the brake on and off, and means for automatically throwing on the brake and simultaneously bringing the sound-box under the influence of the spring.
17. In a talking machine, the combination of a rotatable record supporting table, a cooperating sound-box, a table brake, a spring for throwing the brake in and out of engagement with the table, and a connection through which the spring acts to hold the sound-box clear of the record when the brake is applied.
In testimony whereof, I affix my signature, in the presence of two witnesses.

WALTER H. PUMPHREY.
Witnesses:
E. L. Macoubrey,
M. G. Crawford.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

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1,00 \%, 407
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## UNITED STATES PATENT OFFICE.

## HERMAN WOLKE, OF ORANGE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY. <br> PHONOGRAPH-REPRODUCER.

$1,00 \%, 40 \%$.<br>Specification of Letters Patent. I'atented Oct. 31, 1911. Application filed December 29, 1908. Serial No. 469,882.

To all whom it may concern:
Be it known that I, Herman Worke, a citizen of the United States, and a resident of Orange, Essex county, State of New Jer-

5 Improvement in Phonograph-Reproducers, of which the following is a clear, full, and concise description.
My invention relates to phonograph resion of an improved mounting for the stylus lever in order that the same may have great freedom of movement in tracking the grooves of the sound record, and in order parts may be obviated.
More particularly, the object of my invention is to provide a mounting for the stylus, which shall permit the latter to be
stiented for the line friction nstan in de viese of this character. Fimememome, ow vier is provided which moders it momers sary to mowe any parts oflor than the aly lever itsedf, when suded lever is ascillated lat used in connection with records having two hundred threads to the inch, and track the same faithfully and without injury to the record or the stylus.
While the stylus mounted in the manner of my invention is equally well adapted for use in connection with records having one loundred or some other number of threads per inch, the requirement of great facility of novement of the styhus lever both in a direction parallel to and transverse to the recorl groove, is particularly important in the rase of the two hmadred thread recond or wher record having a great mumber of threads por inch, owing to the thin walls between the reeorel grooves, which might be broken down or jumped actoss by a stylns. the parts moving with, which have considerable inertia, amb wwing to the character of the recomed grownes gencrally. Aceordingly, a stylus momting of the least possible inartia is very desimble. This is provided for in my inventom by providing a miversal pivadal eomeden betwern the stydns lowe "und the member sumperting the pivot, whech member is preferably the nsmat flomting weight well kownll in the mot.

III ordew to climinate intertion and friction 10) the lant possible dearene. my insention compmises a mombling for the stylus hom
erally to the record groove in tracking the same. Furthermore, means are provided by my invention for locating the stylus centrally of the record groove after any deviation from this central position in the tracking of the groove.

Other objects of my invention are the provision of improved details of construction and combination of parts.

In order that my invention may be more clearly understood, reference is hereby made to the accompanying drawings, illustrating a preferred form thereof. in which-

Figure 1 is a central rertical section through a reproducer equipped with my in- 70 rention. Fig. 2 is a bettom view thereof. and Fig. 3 is a detail sectional riew throngh the floating weight and the stylus lever on the line 3-3 in Fig. 1.

The sound box 1 is formed ly the member 2 . which has formed integralify therewith the neck 3 , to which the phonograph horm may be connected. The diaphragm $t$ is clamped in position between graskets 5 and 6. which are clamped in position betwern the body ? of the reproducer and the ring $T$, which bears serew theads on the periphery thereof, which are adapted to ingrage with serew threats on the interion of cylindrical vertical flange \& of the phonograph borly ? The floating weight! is pixutally comineted ly a pin or setell 10 to 1 member 11. which is pisotally momed be means of the s.tew or show stud 12. Which is secmed in the flanere sof mombere of the reproducere, thus producime a that ing weight which is free to orcillate to a sertain (")ant in a diection erosing the plate of the dia phagm, and alon in a phate sulutantall! parm led to that of the dinphangen in : mani Her well klown in the art. The pin lit er temting from the periphery of the thontiner weight at a puint diametrially oppom to
 within the stirmp 11. "bich "atemberm the alljacont point of the d:anern af the bods
 the thather weight in the varime dimethome possible t11 it. it a manmer will homen in How att.

 "pomite to that whioh carrion the - thlas.
 wall! theerethemgh, athe with whill the70
link 18. which is fastened to the center of the diaphragm in the usual manner, engages. The strlus lever 15 is provided on the unper surface thereof at a point somewhat to the right of the middle of the said lever. as shown in Fig. 1, with a conical recess 19. This inverted cone-shaped cavity or cup 19 is adapted to engage with the point of the pirot pin 20, which is fastened in the floating weight 9 directly above the said cavity 19. The pin 20 is preferably of the fineness of a needle. and the sharpened point of this needle is adapted to engage with the apex of the cone-shaped car-
15 ity 19 in the stylus lever 15 . By this means a universal pirntal connection having friction at substantially only one point is provided, since, when the stylus 16 is in contact with the phonograph record, the cone-shaped
20 carity 19 is held by the pressure of the stylus on the record in engagement with the point of pirot pin 20 . Since. preferably, the arm of the lever from the pirotal point to the point of connection to the link 18 is con-
25 siderably greater than the arm of the lever extending from the said pirot to the stylus 16, the up and down movement communicated to the lever by the engagement of the stylus 16 with the record groore, will be
30 commmicated to the diaphragm 4 with amplitude.

Since it is necessary to support the end of the tylus lever on the end of the lever opprisite that to which the link 18 is con-
35 necterl, and since the needle 20 bearing on the upper surface of the stylus lever furni.hes no such support, a means of support for the lever to hold the same approximately in correct position when the stylus is not in
40 contact with the phonograph record, is proridecl. conninting of a link or wire 21 , attached to stylus lever 15 and passing upward throngl passageway 22 in the floating weight?. Link 21 is formed at the upper
45 end thereof with a liook 23 to which are attached the wire spring 24 sechred to the floating weight as by screw 25, and the -piral spring 2f attached to the floating wreght 9 as $\mathrm{h}_{\mathrm{y}}$ pin 27 . The springs $2 t$ and
5020 are arranged on opposite sides of the wire 21 . The spring 24 hokls the wire 21 in a definite position relatively to the floating "ecight aboye it. the weight of lever 15 sub)jocting spring -4 to flexmre, and the move-
55 ment of lever 15 in a plane at right angles to pirot 20 sulbecting spring of to flexure in ap plane parallel th said movement of the -tyluseres: "piral pring of co-acts with aill suring 2 in holding the connection 21
su in its central poition, in which position the - pring 2t is free from looth tension and momperis. Mowement of the lever 1.5 to rither side of its normal axial position extrond -pring ots. Thas. beth springs co-act
fos with gentle fore to maintain the strlus
lever in a central position relative to the record groove, although allowing the lever to yield laterally in tracking the record groove. The function performed by the tro springs just described could be performed by a single spring, but I prefer the arrangement just described, as it is one which permits greater rapidity and certainty of action.
It is understood that my invention is not limited to the precise device or construction shown, but may be varied within the scope of the appended claims without departing from the spirit of my invention.

Having now described my invention, what I claim and desire to secure by Letters Patent of the United States is as follows:

1. In a phonograph reproducer, the combination with the diaphragm, and the floating weight, of a stylus lever, a stylus borne thereby and a comection between the said lever and the said diaphragm. and a pivot for said lever anchored in said weight and haring a pin and socket connection with said lever, substantially as described.
2. In a phonograph reproducer, the combination with the diaphragm, and the floating weight, of a stylus lever, a stylus borne thereby and a connection betireen the said lever and the said diaphragm. and a pivot for said lever anchored in said weight and having a non-positive connection with said lever. substantially as described.
3. In a phonograph reproducer, the combination with the diaphragm, and the floating reight, of a stylus lever, a styhis borne thercby and a connection between the said lever and the said diaphragm, and a pivot for said lever anchored in said weight and having a non-positive connection with said lever, around which said lever is free to oscillate in plames at right angles to each other, substantially as described.
4. In a phonograph reproducer, the combination with the diaphragm, and the floating weight. of a stylus lever, a stylus borne thereby and a connection between the said lever and the said diaphragm, and a pivot for said lever anchored in said weight, and having a substantially single point connection with said lever, substantially as describerl.
5. In a phonograph reproducer, the combination with the diaphragnt, of a stylus lerer mounted entirely below the same and comected at one end with the diaphragm, a stylus borne by the other end of said lever, a member carrying the pirot for said lever, and said pirot. consiting of a pin having its lower extremity bearing against the upper surface of said lever between said diaphragm connection and said stylus, said leree being rotatable about the center line of said pirot as an axis, substantially as described.
(6. In a phonograph reproducer, the com- ino
bination with the diaphragm, of a stylus lerer mounted entirely below the same and connected at one end with the diaphragm, a stylus borne by the other end of said lever,
${ }_{5}$ a member carrying the pirot for said lever, and said pirot, consisting of a pin having its lower extremity bearing against the bottom of a depression in the upper surface of said lever, the lower extremity of said pin
10 fitting closely within the bottom of said depression, said lever being rotatable about the center line of said pirot as an axis, substantially as described.
6. In a phonograph reprochicer, the combination with the rliaphragm, of a stylus lerer mounted entirely below the same and connected at one end with the diaphragm, a stylus borne by the other end of said lever, a member carrying the pirot for said lever.
20 and said pirot, anchored in said member and having a non-positive connection with said lever, said lever being rotatable about the center line of said pivot as an axis, substantially as described.
7. In a phonograph reproducer. the combination with the diaphragm, of a styhes lever substantially parallel thereto and below the same, a link connecting said lever with the diaphragm, and a stylus borne by said
30 lever, a member carrying the pirot for said lever, and said pirot, consisting of a pin having a point bearing against the bottom of a cone-shaperl depression in the npper surface of said lever, said lever being rotatable about the center line of said pirot as an axis, and means for centering said lever, substantially as described.
8. In a phonograph reprotucer, the combination with the diaphragm, of a styhns 40 lever, a link pivoted to said lever and conneeting the same with the tiaphragm, a styhis bome by sad lever, a member carrying the pivot for sainl lever, and said pivot. consisting of a pin having a point bearing
45 against the boftom of a conc-shaped depression in a surface of said lever, said lever being free to oseillate aromed said point miversally, substantially as described.
9. In a phonograph reproducere, the com-

50 bination with the diaphragn, of a stylns lever momed bedow the same, a link piented to one comd of satid lever and embereding the same with the diaphragin, a stylns beme ly said lever, : member ramying the pivot
55 fon salid lever, and salid pisut, consisting of a pin having its Inwer extemity bearing
 lever, and means low shppoting sald low (11) the sidke of sald pixol upposite (1) sated

60 link when the stylus is mot int comband with the record, sulstant ially anderemped.
11. II a phonographi mproducer, the "...n
 ber monted below the same, al link pisuted
br 10 one cond of surd lever and commerting tha
same with the diaphragm and a strlus borne by said lever, a member carrring the pivot for said lever, and said pirot. consisting of a pin having its lower extremity bearing against a point on the upper surface of said lever, and means for supporting said lever on the side of said pivot opposite to said link when the stylus is not in contact with. the record, and ineans for centering sairl lever, substantially as describer.
12. In a phonograph reproducer, the comhination with the diaphragm, of a stylus lever connected with the diaphragm and a stylus borne thereby, a member carrying the pirot for said lever, and said pirot, consisting of a pin having its lower extremity bearing at a point on the upper surface of said lever, said lever being rotatable about the center line of said pirot as an axis. means for supporting said lever when the stylus is not in contact with the record, and spring means for centering said lever, substantially as describer.
13. In a phonograph reproducer, the combination with the diaphrag?n, of a stylus lever connected with the diaphragm and a stylus carried thereby, a member carrying the pivot for sairl lever, and said pirot, about which said leper is arranged to hare miversal motion, and means for supporting said lever, substantially as cleseribed.
14. In a phonographi reproducer, the combination with the diaphr:agm, of a stylus lerel eonnected with the diaphragm and a stylus carried thereloy a member carrying a member with which said lever has pirotal connection when said stylus is in contact with the recorrl, hut which inoes not support said lever, said lever being rotatable about the center line of said last named member as an axis, substantially as deseribert.
15. In a phonograpli reproducer. the combination with the diaphragm, of astyhe lered eonnected with the diaphragul and a stylus carried theredey : member, a sermel member carried therely mad has ing pivotal comedion with said lever when and sthe is in contare wihh the reeord, hat which ilome not support sald lever, said lew berine por tatable alome the erenter line of satid lat haturd momher as an axi*, mal mentr for silpporting satul leme whon mind sl! las is
 :1s dexeribed.

 wr remberded with the di:pplasent and 11



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 dwambed.
17. In a phonograph reproducer, the combination with the diaphragm, of a stylus lever connected with the diaphragm and a stylus carried thereby, a pirot for said lever 5 about which said lever is arranged to have unirersal motion, and about which the lever can oscillate free from the inertia of any other moring parts, substantially as described.
10 18. In a phoncgraph reproducer, the combination with the diaphragm, of a stylus lever connected with the diaphragm and a stylus carried thereby, a pirot for said lever
about which said lever is arranged to have unirersal motion, and a member in which said pirot is supported, said lever haring a morement independent of the said member when said lever oscillates transrerse to the record groore, and the said member also mounted for a limited morement transverse to the said groore, substantially as described.

## HERMAN WOLKE.

Witnesses:
Drer Suith, Axva R. Klehar.

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13,305
$$

A. E. SPENCER \& F. C. THOMAS. MEANS FOR AUTOMATICALLY aRRESTING TALKING MAOHINES. APPLIOATION FILED AJG. 17, 1911.
Reissued Oct. 31, 1911.
13,305.


Fig.3.
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haum 6.8. Ylanch.
B)

By Bn Whigur
Ken autorny.

# UNITED STATES PATENT OFFICE. 

ARTHUR E. SPENCER, OF SAN FRANCISCO, AND FRANK C. THOMAS, OF MILI VALLEY. CALIFORNIA.

## MEANS FOR AUTOMATICALIY ARRESTING TALKING-MACHINES.

$13,305$.
Specification of Reissued Letters Patent. Reissuled Oct.31, 1911.
Original No. 998,807, dated July 25, 1911. Serial No. 593,636. Application for reissue filed August $17,1911$. Serial No. 544,711.

## To all whom it may concern:

Be it known that we. Arthitr E. Spencer and Frank C. Thomas, citizens of the Tnited States. residing, respectively, at San
5 Francisco, in the county of San Francisen, and Mill Valley, in the comnty of Marin, and State of Califormia, have invented new and useful Improvements in Means for Automatically Arresting Talking-Machines, of
10 which the following is a specification.
This invention relates to means for arresting the rotation of a talking machine antomatically upon the stoppage of the sounds prodiced by the talking matchine.

One olject of the invention is to provide a device for aceomplishing this and which will not necessitate any change in the form or constrantion of the record itself or in the mode of msing the talking machine.

A further objeet is to provide such a devire of a very simple construction.
In the accompanying drawing, Figure 1 is a broken plan view of a talking machine equipped with our invention: Fig. 2 is a
25 broken side view thereof; Fig. 3 is a detail woss section on the line 3-3 of Fig. 1; Fig. 4 is : detail remtiral section on the line $a-a$ of Fig. 1: showing the positions of the parts. when the tone tube is elevaled; Fig. . 5 is a smilar vew showing the posithons of the parts when the tone tube is lowered to its operative position; Fig. 6 is a similar view showing the positions of the parts when the tone tube is also in the lower position but
35 the pin has armed at the end of the reemerl.
Reforing to the drawing, mon the thimbe 1 which secures the trme tube 2 to the sound tube 3 is rigidly secured, :s by sewws 4, an arm tr, from the end of which depmends
40 : 1 lexp (fi. Alsin secmer to said thimble is a sumall beacked 7, formed with a soncket 8 . in which (an turn a ball 9, hat ving a bembing 10 in which call slide a fore 11 the emb of said rod having: a head 12 amd said rod has-
45 ing eothar 13. Said head and collar prement the row sliding one of its be:ring IO. Tha rod is flatemed where it passes therombthe bearinge, sin that it anmot burn therein, amt the baill has 11 pin 10 in "10.st 11 in the
50 bracket to prevent the terning of the ball


 fower and 1 is is formed with a besting 1.4
in which is secured a small piece of catgut 55 18 the lower end 16 of which preferably tapers to a fine point. Said bearing 1 it is so formed that the catgut can easily be removed and a new piece inserted therein when necessary.

The loop of tapers toward the lower end, so that, when the tone tube is raised, the rorl 11 passing throngh said loop 6. rests in said lower end thereaf and when the stylus 17 of the talking machine is lowered on to the record 35, the end 16 of the catgut assumes, a position slightly neurer the center of the record than the eind of the stylns 17. When the eatgut descends into contact with the record, it. and the rod 11, are smpported ly the record. but the loops 6 can drop a shonit distance lower so that the rod 11 no longer contacts with said loop, but assmmes a poxition centrally thereof, ats shown in Fige I. When the roid 11 no fonger rests in the bottom of the loop the catgut would. but for the groove in the record, be shifted by the rotation of the reeord in al tramsiense or radial direction ower the record, mitil the roxd 11 assmmed a tangential position with references to the cibele deseribed on the receord bey the lower end of the catent, and liefore it arrived at this position. The bearingr 1.1 would contant with the stylns 17 . 1311 on ateromit of the record being gromed, this result doese mot take place, for the catent is. by the weight of the rod 11. herd in the



 pellel to follow satil groon :lwar - light! within, of in alsane of, H10 arliss. How




 Hrmend of the reemet, atml, in the mathom of










23 to a galranic cell 24 preferably contained in the box of the talking machine. Since as commonly constructed the reproducer 21 is supported upon the tone tube 2 by an interposed sleere 19 of rubber, the electric circuit is not closed by said tone tube. In this circuit is an electro-magnet 25 which attracts an armature 26 on a stem sliding in bearings 28 and which carries a collar 29 adapted to actuate the lever 30 used at present to operate the brake 31 of the talking machine. When said lever is actuated, it breaks a contact in the circuit 20 , consisting of said lever 30 and a bent wire 32 secured to the electromagnet. When the brake 31 is remored, said contact is again closed by the lever, and the circuit 20 is open at the stylus and catgut holder, and is adapted to be closed in the same manner as before.
When the tone tube is raised for use with another record the arm 11 drops into the tapering lower end of the loop. 6, and the holder is therefore out of electrical connection with the stylus. also said arm slides back in its bearing until the collar abuts against the bracket so that the catgut is out of the way when remoring the stylus and replacing it by another.
Tre do not confine our insention to the 0 arrangement here shomn in which the stylus itself closes the electric circuit, controling the brake, as this electric circuit may be closed by contact of any parts moring respectively with the catgut on the one hand 35 and the stylus on the other. Nor do we limit our invention to the means here shown for producing said relative motion, said means being the oblique arrangement of the rod 11 to the arm carrying the stylus, as 0 any positive means could be employed to produce this relative movement when per-
mitted to do so by the arrival of the catgut at the end of the spiral groore.

We claim:-

1. In combination with a rotating record
haring a record groore, a talking machine haring reproducing mechanism, adapted to engage said groore, a derice engaging the groove at a different point from the reproducing mechanism, an electric circuit, means morable respectively with said device and said reproducing mechanism and connected to opposite sides of said circuit to close the circuit by contact with each other due to a morement relative to one another of said reproducing mechanism and derice, an elec-tro-magnet in said circuit, and a brake for the record controlled by said electro-magnet, substantially as described.
2. In combination with a rotating record haring a record groore, a talking machine haring reproducing mechanism, adapted to engage said groore, a holder carried by said talking machine, a filament carried by saic holder and engaging the groore at a different point from the reproducing mechanism, an electric circuit. means morable with said reproducing mechanism, said means and said holder being connected to opposite sides of said circuit to close the circuit by contact with each other due to a morement relative to one another of said reproducing mechanism and holder, an electro-magnet in said circuit, and a brake for the record controlled by said electro- 75 magnet. substantially as described.

## ARTHUR E. SPENCER. FRANK C. THOMAS.

Witnesses:
Francis M. Wright,
D. B. Richards.

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1007605
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T. H. MACDONALD.

POSITIVELY FED DISK GRAPHOPHONE.
APPLICATION FILED JAN. 8, 1909.
1,008,605.
Patented Nov. 14, 1911.

T. H. MACDONALD.

POSITIVELY FED DISK GRAPHOPHONE.
APPLICATION FILED JAN. 8, 1909.
$1,008,605$.
Patented Nov. 14, 1911.


# UNITED STATES PATENT OFFICE． 

## THOMAS H．MACDONALD，OF BRIDGEPORT，CONNECTICUT，ASSIGNOR TO AMERICAN GRAPHOPHONE CONIPANY，OF BRIDGEPORT，CONNECTICUT，A CORPORATION OF WEST VIRGINIA． <br> POSITIVELY－FED DISK GRAPHOPHONE．

$1,008,605$.
Specification of Letters Patent．Patented Nov．14， 1911. Application filed January 8，1909．Serial No．471，332．

## To all whom it may concern：

Be it known that I，Thonas H．Macdon－ ALD，a citizen of the United States of Amer－ ica，and a resident of Bridgeport，Connecti－
5 cut，have invented a new and useful Im－ provement in Positively－Fed Disk Grapho－ phones，which improvement is fully set forth in the following specification．

This invention relates to talking－machines 10 employing a sound－record in the form of a disk，and preferably having the record－ groove of the up－and－down type rather than of the usual zigzag type．

The object of the invention is to provide，
15 for such talking－machine，positive means for feeding the sound－box across the face of the record－disk．

Another obiect is to permit the use of a disk sound－record having double，or more than，the usual number of convolutions to the inch．
With the ordinary form of disk sound－ record，where the record－groove is of the so－called＂zigzag＂type，of substantially
25 uniform depth，the side walls of the groove serve to propel or feed the sound－box，be－ sides vilorating the styhus and its diaphragm； but a record－groove of the vertically mondi－ latory type，with varying depth，owing to
30 the comparative shallowness of the groove， and the comparatively gentle slope of its side walls，wonld not suffice to feed the sombdores with certainty．Again，by pro－ viding a positive feed，the machine may be
35 employed，with a suitable recording－stylus， for making the original reeordings mon a tablet of suitable material ；and such record－ ing－stylus may be momied to vibrate cither lomgiturlinally of its axis（to and from the
40 tablet）or latemally，to prodace cither the vertically－mudulating or the laterally modn－ latiag type of somed－renerd．

One feature of the insention comsists of providing ：spiral lhead or feed－serwin la
45 neath the furn－tahle lhat carvies the disk remod ：and concentric therwitl，mad in co－ Opreation with satid surew a ernide pin on


50 （smbstantially ratially）across fle face of the recold－disk．

Shother featme of the intention monists
 depmencot disk sepparate from the remed 55 carrying disk，midgiving the foed－serew ：
comparatively coarse pitch，while providing reduction－gearing whereby the compara－ tively－slow rotation of the comparatively－ coarse feed－screw will feed the somul－box at the proper rate across the face of a record－ disk provided with a comparatively－large number of convolutions per incl．

Still another feature of the invention con－ sists of means for disengaging the reproduc－ ing－stylus from the record－groove，and for disengaging the feed－arm from the spiral feed－screw，the two actions being preferably performed simultancously．

The invention consists of one or more or of all of the foregoing features，and also of the various details of construction and ar－ rangement to be hereinafter pointed out and claimed．

The invention will be best muderstood by reference to the annexed drawings that illus－ trate a preferred embodiment thereof ap－ plied to a machine carrying a disk record whose record－gruove is of the vertically－ modulatory type．

In the drawings，Figure 1 is a vertical section thomgh a portion of a disk grapho－ phone，ilhsitrating a preferred cmbodiment of my invention：Fig． 2 is a plan view of the same，partly broken away：and Fig． 3 is a detail，viewed from the left in lig．I！
lieforring to the drawings， 1 represents the box or casing of the graplophames，com－ taining any standard motor，either spring （1）electric（not shown）．

2 is the rertical turn－tahber shaft rotated so Dey the motor，heminafter termed the main shaft ：＂1pen the＂ppere end of this is mame． ed Hoe nisual horizomtal turn－tabhe ：3，Hat rarties the disk somblrendal，whose med ord－yrome is a fepiral grtand of bar ine

 ally the comblations of fla remal sroove ＂In⿻日土 this disk 4 arn twohmatred（20）to thu ind which is doulde the anmal pramtice．


 the bathent $5^{5}$ to swige in a horizontal phate
 －mather ent the sommblow io hating the huri\％ntal diaphonam：parnltel for tha face

 the fres onter end of the urim $i$ ：and the 110
front portion of this tube is cut away to receive the yoke 11 that is secured to the pin. The floating-weight 12 has a square hole, and is passed upward to receive the tube and pin with its yoke; and this floatingweight is secured to the yoke by the horizontal pivot-pin 13, so as to swing to and from the diaphragm 9 , its play being limited by the usual pin and staple at its free outer end. A spring $13^{\prime}$ forces the weight 12 downward. The reproducing-stylus 14 is carried on a lever that is pivoted to this floating-weight, the other end of said lever being comnected to the center of the diaphragm by a link that passes through an aperture in the weight 12 . The rear 15 of the floating-weight extends beyond its pirot 13. By means of swirel 10 and pivot 13, the floating-weight and its stylus have slight lateral play as well as vertical swing.

16 is a sleere mounted on the main shaft 2 and freely revolving independently thereof; and 17 is a horizontal metal disk fast on sleeve 16, located beneath turn-table 3 and provided at 18, preferably on its lower face, with a spiral screw-thread whose pitch is forty (40) to the inch. It will be understood that this inverted spiral thread or feed-screw 18 is concentric with the concrably abont opposite stylus 13 . A spring
27 , seated in the portion 24 , tends to depress crably abont opposite stylus 13 . A spring
27 , seated in the portion 24 , tends to depress the heel of the lever 25, , and thereby holds
the guide-pin 26 in engagement with the the heel of the lever 2.5, and thereby holds
the guide-pin 26 in engagement with the
60 feed-screw 18. The upper member 28 of the lever 2:) terminates just abore the heel 15. of the floating-weight, so that when the guide-pin 26 is forced out of engagement with the feed-screw by swinging lever 25 65 downward, then the member 28 will depress

19 is an mountel parallel to the main shaft arbor mon the 20 in mesh with gear 21 fast on main shaft 2 , while pinion 22 carried by gear 20 is in mesh with gear 23 on the sleere 16 . The reduction in speed from gear 21 to gear 20, and then from pinion 22 to gear 23 is fire (5) ; so that the turn-table 3 and soundrecord 4 will make five (5) revolutions to 40 one (1) revolntion by the feed-screw-disk 17. It will be understood, of course, that the figures forty ( 40 ) to the inch for the spiral feed-screw, two-hundred (200) to the inch for the convolutions of the recordgroore, and five (5) for the reduction-gearing, are merely for the sake of illustration; and that this ratio may be raried as desired.

From a point near the center of the hollow arm $\tau$ is the depending portion 24 , and 50 in a slot in the bottom thereof is piroted the substantially-U-shaped lever 25 , that lies in the same rertical plane with hollow arm 7 : the lower and longer member of this lever carries the guide-pin 26 , adapted to engage in the inverted spiral feed-screw 18, pref-
the heel of the floating-rreight and swing the main portion of th eweight upward, and thereby lift the stylun 14 out of engagement with the record-groove.
29 is a cam-lever mounted on a horizontal
pirot on the side of the hollow arm 7 , and co-acting with the horizontal pin 30 on the upper member 28 to swing the entire lever 25 downward; while spring 27 will restore it.
31 is a stop-pin to limit the inward swing of the arm 7 and the sound-box.

In the position shown in Fig. 1, cam 29 permits spring 27 to force the guide-pin 26 into engagement with feed-screw 18 , while the upper member 28 permits the stylus 14 to enter the record-groove on disk 4; but when the handle of the cam-lever is moved into the position 32 , then the guidepin 26 is forced out of engagement with the feed-screw, and simultaneously the arm 28 causes the stylus 14 to be disengaged from the sound-record. Preferably the beginning of the record-groove of disk 4 will be near its center, and the sound-box and stylus will be fed from the center outward; so that by merely moving the cam-lever to the position 32 , and swinging the arm 7 against the stop 31 , and then restoring lever 29 , the machine is in proper position to begin the audible reproduction of a sound-record.

When the record-disk 4 is of the ordinary zigzag type, the stylus 14 will be carried on an elbow lever mounted upon the floatingweight 12 , transversely of the record-groove, so as to transform the lateral or zigzag vibration of the stylus to rertical vibrations of the horizontal diaphragm; or the mechanism could be otherwise adapted to a ver-tically-arranged diaphragm, without departing in any case from the spirit of my invention.
I have shown the hollow arm 7 as pivoted so as to have horizontal morement only; but this arm could be secured by a universal joint, in which case instead of the cam-lever on the $\operatorname{arm} 7$, a horizontal rock-shaft would be mounted upon a stationary bearing on the casing 1 , to co-act with the lower member of the lever 25 , or some other modification could be employed for engaging and disengaging the stylus and the guide-pin respectively.

While I have shown and described an inverted feed-screw, that is, one whose spiral threads 18 are upon the under face of the disk 17, yet the feed-screw need not be inrerted, but may lie upon the upper face of a suitably-rotated disk independent of the turn-table: in which case the upper member 28 may extend past pirot 13 , or other obvious modifications may be made, in order to engage or disengage simultaneously the stylus and record-groore and the guide-pin
and feed-screw respectively.

I have described my invention with some particularity of detail, but only for the sake of clcarness, since parts of my invention may be used to the exclusion of other parts, and changes may be made in the construction and arrangement of parts, without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. In a disk graphophone, the combination with the vertical main shaft and its turn-table adapted to carry a disk soundrecord, the horizontal swinging-arm carrying a sound-box, a floating weight pivoted ${ }_{1 E}$ upon said sound-box, and the stylus carried thercby and adapted to engage said soundrecord, of an independently revoluble disk on said main shaft beneath said turn-table and presenting on its lower face a spiral tween of leed-scr, fordind tically-swinging $U$-shaped lever carried by said swinging arm and having one member extending beneath said feed-screw, a guide-
25 pin carried by said member and adapted to engage said feed-screw, the other member of said lever extending above the rear extension of said floating wcight, a spring forcing said lever upward to engage said guide-pin and
30 feed-screw and said stylus and sound-rccord respectively, and a cam-lever adapted to depress said U-shaped lcver and thereby disengage said parts.
2. In a disk graphophonc, the combina-

35 tion with the revoluble turn-table adapted to carry a disk sound-record, the swinging arm carrying the sound-box, a floating weight pivoted on said sound-box, and a stylus carried by said floating weight and adapted to
46 engage said somind-record, of an inverted spiral thread or feed-screw beneath said turn-table, a vertically-swinging U-shaped lever carried by said swinging arin and having its members adjacent said feed-screw
45 and floating weight respectively, and means for moving said lever upward and downward respectively for engrging or disengaging said gude-pin and feed-screw and silicl stylus and somud-record.
3. In a disk graphophome, the combination with the durn-table, the swinging amm and somed-box, and a floating weight canried by said sombl-box and carrying flo stylus, of a lever cantiod liy said swinging an 55 :and extending ower the rear extension of said floating weight, and means for moving said lever up or down for towering or raising said floating weight and therdy (In gaging or disengaging satid stylas and the
4. In a disk grophophone, the combina tion with the darm table adaphen to candy a disk somal-recond having a spionl peodel grown (herem, has swinging nom carrying
lus mounted on said sound-box and adapted to engage the said record-groore, of an inverted spiral feed-screw whose thread is concentric with the convolntions of said sound-record, means actuated thereby for propelling said sound-box and stylus, and a lever and suitable connections for simultaneously placing the feed-mechanism and the reproducer into and out of operative position.
5. In a disk graphophone, the combination of a horizontal turn-table, an arm swinging horizontally above the same and carrying at its free end a horizontal diaphragm, a floating-weight pivoted upon said arm and carrying a stylus connected to said diaphragm and adapted to engage the record-groove of a disk record upon said turn-table, an inverted spiral feed-screw, a U-shaped member pivoted on said arm and carrying at one end a guide-pin engaging said feed-screw, the other end thereof adapted to raise said floating-weight and stylus, and means for raising or lowcring said U-shaped member.
6. In a disk graphophone, the combination of a horizontal turn-table, an arm swinging horizontally above the same and carrying at its free end a horizontal diaphragin, a floating-weight piroted upon said arm and extending forwardly beneath said diaphragm and rearwardly beyond its pirot, a stylus pivotally momted on said floating-weight and comnected to said diaphragm and adapted to engage the recordgroove of a disk record upon said turntable, an inverted spiral feed-screw, a Uslaped member pivoted on said arm to swing vertically, a guide-pin carried on the lower member thereof and engaging snid feed-screw, the other end of said U-shuperd member extending above the rearward extension! of said thating-weight, mul means: for swinging salid member mpard or downward to engage or disengare the stylns and record-gronse and the gulide-pin uind leadscew respectively.
7. In a disk talking-madine, the combination of the homizontal fimelable, the horizontal swinging artu carreng the dianphrugm mad its free ond aboise satid forn table, the fleating weighth mombleal to hase
 duphungm and finm talde and porided wifl lateral plas. the mslus piowtally mumbted upmon said ilonting weright mad having rommedion with satid, diaphagun, a lever mombed upon satid swiuging arm nad oper ating (1) ruisw sibl thating - weight mond sty


$\therefore$ St 11 diak ballime machime, tha combination with the turn falde and the swingint:


tive spiral feed-screw, a floating-weight carried by said arm, a stylus-lever piroted on said floating-weight and connected to said diaphragm, a stylus on said stylus-le-
$\varepsilon$ rer adapted to engage a disk sound-record upon said turn-table, a lever pivoted upon said swinging arm and at one end carrying a guide for engaging said feed-screw and at the other end acting upon said floating-
to engage or disengage said stylus and the sound-record and the said guide and feedscrew respectively.

In testimony whereof I have signed this specification in the presence of two sub- is scribing witnesses.

THOMAS H. MACDONALD.
Witnesses:
H. B. Keough,
L. B. Nicholson.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."

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A. N. PIERMAN.

SOUND REPRODUCER.
APPLICATION FILED MAY $1,1909$.
$1,010,311$.
Patented Nov. 28, 1911.

Fig. 4


Fig. 3


Frong


# UNITED STATES PATENT OFFICE. 

# ALEXANDER N. PIERMAN, OF NEWARK, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY. 

SOUND-REPRODUCER.

Specification of Letters Patent.
Patented Nov. 28, 1911. Application filed May 1, 1909. Serial No. 493,281.

## To all whom it may concern:

Be it known that I, Alexander N. Pierman, a citizen of the United States, and a resident of Newark, in the county of Essex 5 and State of New Jersey, have made a certain new and useful Invention in Sound-Reproducers, of which the following is a description.

My invention relates to talking machines 10 of the pneumatic type, or, generally speaking, of the type in which undulations corresponding to sound waves are impressed upon a current of any snitable moving fluid by the operation of a suitable valse through
15 which the fluid is allowed or cansed to pass, the value being operated in accordance with the sound waves, as by connection with a reproducing styhs tracking a record groove.

The objects of my invention are to con-
20 struct a sound reproducer in which the moving fluid is cansed to operate a sensitive valve of a novel character in a novel manner, whereby a somed reproduction of clear and excellent qualities and the desired de-
25 gree of londness or amplification is secured.
The valve or vibatory member or menbers constructed in accordance with my invention is of minimm mass, wherchy defeets due to inertia and momentmo of parts are largely aroided. lin aceordance with these oljecets, thin, flexible, reed-like members are interposed in the path of the mosing fluid current and are vibated in arcondance with somed vilsations (o set up 35 corresponding madulations in the mening flaid emrent in the somed bax of the reproducer.

In the prefered form of my invention, a port plate is provided having eme ore more
40) slit-like perts thewein, "10, which ports we seated thin, Itexible, reed-like mentures of elastice material which are placed muder twa sion :mble seemed to the pert plate :1t buth mals. Also, preferally, hase reed-like mem
45. bers are bumished we whernine given sum I1 canformation that they sent "1men the monthe of the forts in chise conlant, patly willint the sumb, to acourately Flese the sulled perts wlow hae mombers inve in their

 needion will thes stylus to bat? the evernt of operning of the perts lo at grenter ous

tions which originally produced the record 55 groove tracked by the stylus.

Other objects of my invention than thuse referred to above will appear below in the specification and claims.

So far as I am aware, the valves or vibra- - 60 tory members of devices of the general type referred to above constructed prior to my invention have been generally in the form of rigid plates or bodies which are moved bodily in accordance with sound vibrations bj to rary the extent of opening of the ports, as by moving the same in planes perpendicular to the plane in which the mouths of the ports are sitnated, or parallel thereto, or by an angular movement, the valves being io piroted or balanced on a knife-dge, or the like, at one side of the ports. It has also been proposed to constitute the valve of elastic material and secure it firmly at one extremity, and vibrate the same across the io port opening in the manner of a tming fork, the material of the valse flexing chicfly in a line adjacent to its point of support. this manner of moming being therefore similat to the pivetal momining refermed to abone In the case of the rigid lalves a comsiderable amome of mass is heressitated. "ith comseghent inertial and loss of semsibiseness, mad int the case of the vibatery rulter lat ree ferred to, it has been imposithe to make fle (ongyes thin and light. since in that canc they mighe set up andible viluatioma of the ir own. The recd-like members of my insention, on the combary, are hed at haith cmesproferably umder tensin, and heme vibate ? nut like (mange fork ham lat her in the mannue of violin stringre Thu amblers, honexer, is nel complete. The real hbe ment















tion, of a sound reproducer embodying my invention. Fig. 2 is a plan riem of the port plate with the ralve members secured thereto. Fig. 3 is an enlarged fragmentary cross s of the ring 9 which is scremed into the depending flange 10 of the sound box to hold the closure 8 tightly in position. The floating weight 11 is pirotally mounted at 12 to the block 13 which is mounted as by the screw 14 on the lower surface of the depending flange 10 . 'The stylus lever 15 is pivotally mounted at 16 to the lugs 17 depending from the floating weight, and the said 30 stylus lever is provided with stylus 18. All of the abore mentioned parts are common.

The ports 4 , which are preferably in the form of lengthened slits, are normally closed by means of the flexible reed-like members 19 seated upon the same. These formed of a light metal such as aluminuum. These reeds are secured in position on the port plate by fastening them securely to the
40 same at both their ends at the opposite extremities of the ports. I prefer to secure the reeds 19 in position by the means shown in the drawings. As there illustrated, the strips 20 and 21 are placed transsersely
45 across the ends of reeds 19 beyond the two extremities of the ports 4 , and screws 22 are screwed through the strips 20 and 21 and into the port plate 5 , the shanks of the screws extending between the reed-like
50 members 19 and the heads of the screws each orerlapping one of the said reeds 19 on each side of the same. By this means a very secure connection is made which is at the same time detachable. It is, of course,
55 obvious that members 19 might be secured permanently to the plate 5 as by solder. The reeds 19 are fastened together as by strip 23, which is soldered or otherwise se cured to the same transwersely of the same
60 and midway between the strips 20 and 21 . The link $2 t$ which is attached to the tail of stylus lever 15 is also secured to strip 23. I prefer to use the construction shown in the drawings, in which link $2 t$ passes 65 through a hole in strip 23 and is provided
on the upper side thereof with a button or head $2 \overline{5}$, so that the upward morement of strlus 18 in tracking the record groove pulls the reeds 19 downwardly at their central points, the pressure of air or other fluid passing from chamber 3 through ports 4 into chamber 2 tending to constantly keep the reeds 19 flexed upwardly. The result of this construction is that when the stylus 18 passes into depressions in the record groove, the current of air or other fluid passing through the port plates flexes the reeds 19 to open the ports to a greater extent, while when the stylus 18 passes over hills or shallower places in the record groove, the link 24 draws the reeds 19 down to reduce the extent of opening of the ports. It is, of course, obvious that the proportion of parts as shown could be changed without departing from the spirit of the invention, and that, if desired, the direction of flow of the fluid could be reversed and the ralve seated on the opposite side of the port plate $\overline{5}$ from that indicated with appropriate connection to the stylus lever.

Preferably, the reeds 19 are secured in position and held under a uniform tension. This may be secured in a number of ways, as. for example, that indicated in Fig. 4. Here, the port plate 5 is represented as being formed with slightly raised bearing surfaces surrounding the orifices of the ports on the side of the plate on which the reeds are mounted, the lips so formed haring their edges rounded with a smooth curve beyond the ends of the slit-like ports, as shown at 26. The reeds 19 are placed in position orer the ports 4 and are so held temporarily by any suitable means. The screws 22 are then secured in position in the portions of the port plate of reduced thicliness, as indicated, and by the pressure produced by their heads upon that portion of the reeds 19 lying on curved portions 26 of the port plate 5 , a tension is produced which is the same in all the reeds 19 , since the adijustment of screws 22 is the same in each case. When the reeds 19 have been properly secured in position, they are preferably forced into close contact with their bearing surfaces, and bent somewhat into the mouths of the ports, in any snitable manner, as with a burnishing tool, as indicated at 27 in Fig. 3 , to cause the said reerls 19) to conform closely to the irregularities of the mouths of the ports, and thus normally seat themselves accurately and closely thereon. The valve so produced operates entirely by elastic flexure, vibrating back and forth in symmetrical ares to a rery slight extent to increase or decrease the amount of port opening and admitting the current of air into the chamber 2 in a series of puffs. It would seem that the reeds 19 normally entirely close the ports 4 . The valre so constructed
is exceedingly sensitive and copies the vibrations of the stylus with amplification and with great faithfulness. Any desired number of ports and corresponding reeds may be used, the loudness of the sound reproduced varying with the number used.

Where, in the various claims, I have referred to members seated upon the ports, it is to be understood that the reed-like memor the lower surface of the port plate as preriously stated, and by the language used I do not limit myself to the seating of the members upon the upper surface of the plate merely:
Having now described my invention, what I claim and desire to protect by Letters Pateut is as follows:

1. In a sound reproducer, the combination bow body containng chanbers communicating through a plurality of ports, stretched members of elastic material held rigidly at both extremities, seated upon and covering satid ports, and means for flexing vibrations, substantially as described.
2. In a sound reproducer, the combination of a hollow body containing chambers communicating through a port, a stretched bothoer of elastic materiar held rigidy. at both extremitics, seated upon and covering said port, and means for flexing the said member in accordance with sound vibrations, substantially as described.
3. In a sound reproducer, the combination of a hollow body contaning chambers communicating through one or more ports, thin member's of elastic material seated one upon each of said ports, means situated at 40 both extremities of said members for holding the same immovable at both ends, and means for flexing the said members in accordance with somed vibrations, snbstantially as described. vil 1 a soma reproner, tur a fluid therethrongh, of elongated llexible means interpersed in the path of said Hund for prodnemg mululations therem by its
50 flexure, and neans for llexing the said nemas in ares having their wontow in or single struight line in aceodance with somme vibrations, subatantially as described.
$\therefore$ In a somel exproducer, the embhation 55 with a somm box and meats for combeying a Hnid therethrongh, al a vibating thin strip interpensed in the path of said fluid
 madnlations in satid thit, and means for
60 cmasing sand arrip to vilnate substmmtall! ass whole in ateordunce with somad vilmatioms, substantially as described.
(i. In a somal repredicer, the comblanation with as stmad box and mesus for comereyige 65 "1 flated theretlorongh, of a vibrating thin
strip interposed in the path of said fluid and held only at both ends for producing undulations in said fluid, and means acting upon said strip substantially midway betreen its ends for causing the same to vibrate in accordance with sound vibrations, substantially as described.
4. In a sound reproducer, the combination with a sound box and means for convering a fluid therethrough, of a member interposed in the path of said fluid and prorided with a passageway through which the Iluid passes, and a vibratory reed covering said passageway and held firmly at both ends, and means for flexing the said reed to uncover the said passageway more or less in accordance with sound vibrations, substantially as described.
5. In a sound reproducer, the combination with a sound box and means for convering a fluid therethrough, of a member interposed in the path of said lhuid and provided with a passageway through which the fluid passes, a vibratory reed field under tension and secured at both ends to cover said passageway, and means for flexing the said reed to uncorer the said passageway more or less in accordance with somd vibrations, substantially as described.
6. In a sound reprodncer, the combination of a hollow body containing chambers communicating through a plurality of slit-like ports, vibratory recd-like members of somewhat elastic naterial seated one noon ench of said ports and covering the same, me:mis for securing fixedly both the ends of all said members, and means for flexing all said member's together to open sald ports. more or less in accordance will somad vibrations, substantially as described.
7. In a sound reproducer, the combination of a hollow body contaning chamhers communicating throngh a phantity of slitlike ports, vibratery red-like members of somewhat elastie material siated one no on earh wf snid ports nad motering the same mesans for holding all sad members madra un "qual tembion and anchoring the conds therenf, and mans for fle xing alf satid mem
 in actordance with sumbl vilurations, and)stantially us dempiled.
8. Lii a combl reproducer. He combinafion of a hollow borly contaming chambers
 a raloc of ratic material rigidly held at both coul mal catal 1 poon said prots, and mande for thexing the :atid bato for bare ing the extent of oproning of side perts in
 bially an duerilued.
9. In in tumd reproducer, He combimation of a hollow loody comtnining chambers
 thin reed like members of elastio materinl
normally seated upon said ports and conrexed somewhat to fit accurately into the adjacent orifices of the same, means rigidly holding the ends of said members and means for flexing the said members. for varying the extent of opening of said ports in accordance with sound vibrations, substantially as described.
10. In a sound reproducer, the combinacommunicating through one or more ports, thin reed-like members of elastic material normally seated upon said ports and constituting a valve, means holding said members rigidly at both ends, a stylus, and connections from the said stylus to the said members for flexing the latter in accordance with the movements of the former in tracking a sound groove, substantially as described.

14 . In a sound reproducer, the combination with a sound box, of a ported plate therein, means for introducing fluid into said sound box on one side of said plate, a member or members of elastic material secured upon said plate and covering the port or ports in the same on the opposite side thereof, a stylus and a one-way connection from said stylus to said member or meni-
plate in accordance with movements of said stylus in one direction, substantially as described.
15. In a sound reproducer, the combina-
tion with a sound box, of a ported plate therein, means for introducing fluid into said sound box on the lower side of said plate, a member or members of elastic material secured upon said plate at both extremities and covering the said port or ports in the same on the upper side thereof, a stylus below the plate and a one-way connection from said stylus to said member ori members for flexing the same toward the said plate in accordance with movements of said stylus in one direction, substantially as described.
16. As a new article of manufacture, a port plate for an air sound reproducer, having slit-like ports therein, and thin flexible reed-like members seated upon said ports and bent or forced into position to normally closely cover the same, substantially as described.
17. As a new article of manufacture, a port plate for an air sound reproducer, having slit-like ports therein, thin flexible reedlike members seated upon said ports and normally closely covering the same, and secured to the port plate at both ends, sub- 60 stantially as described.

This specification signed and witnessed this 30th day of April 1909.

## ALEXANDER N. PIERMAN.

Witnesses:
Dyer Suithe,
John M. Canfield.

$$
1,010,333
$$

P. WEBER.

PHONOGRAPH HORN.
APPLIOATION FILED MAR. $31,1908$.
1,010,333.
Patented Nov. 28, 1911.


Milansses:
 Straits Ar tyke Ally.

# UNITED STATES PATENT OFFICE. 

PETER WEEER, OF ORANGE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THOMAS A, EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORAIION OF NEW JERSEY.<br>PHONOGRAPH-HORN.

$1,010,333$.<br>Specification of Letters Patent. Patented Nov. 28. 1911. Application filcd March 31, 1908. Serial No. 424,329.

## To all whom it may concern:

Be it known that I , Peter $W_{\text {eber, a citi- }}$ zen of the United States, and a resident of Orange, in the county of Essex and State of
${ }_{5}$ New Jer:sey, have invented certain new and useful Improvements in Phonograph-IIorns, of which the following is a description.

My invention relates to phonograph horns of the type in which the flaring bell is made to the small end or body portion of the horn, and has been preferably embodied in a horn, the axis of which is curved so that the horn extends upward from the phonograph sound
15 box and the mouth of the bell occupies substantially a vertical plane facing in the same direction as the phonograph, as described and claimed in my application filed October 14, 1907, No. 397,283.

The present invention also relates to improved means for flexibly uniting a horn of this character with the sound box of the phonograph.

In order that the invention may be more 25 fully understood, reference is hereby made to the accompanying drawing of which-
Figure 1 is a side elevation of a hom constructed in accordance with my invention and applied to a phonograph which is illus-
30 trated in dotted lines; Fig. 2 is a section on line $2-2$ of Fig. 1; Fig. 3 is a detail plan view of the means for locking the bell to the body of the horn; Fig. 4 is a section on line 4-4 of Fig. 3; ligs. 5 and of are riews
35 similar to 3 and 4 of a modified lueking device; Figs. 7 and 8 are similar views of amwher modification; and Fig. !? is a view similar to the lower portion of Fig. 1 , shoning a phonograph in which the niphle of the
40 sommed box extends rertically and showing a modified constraction of compling for comneeting the lower end of the lown with the said nipple.
The horu shown comprises a hell 1 uf 45 metal, wood or othere suitable material, the shall end of whis:l is provided with or pair of aperfares 2 and in ontwardly extemding pin 3. 4 is a curved seedion of bedy. Hhe simall cond of which is adapted to lie com
50 needed to the somud box of the phomergaphe a. The large emb of the sections a is pro vided with a metnllic ring to of tapered form which has a pair of inwardly projert ing pinus fi adapted to le insorted withan the 55 openinges 2 , und suid ring is formed witl a
notch 7 adapted to receive the pin 3. There is a locking latch 8 piroted at $y$ to the ring 5 , the same being formed with a handle 10 and a cam surface 11. Which tends to draw the bell 1 into the ring 5 with a wedging 80 action, due to the tapered form of these parts.

In the device of Figs. 5 and 6 there is a locking latch $8^{\prime}$ pivoted at $9^{\prime}$ to the lugs 12 which are rigid with the ring 5. The forward end of said latec $8^{\prime}$ is provided with a handle $10^{\prime}$ and the latch has an opening $11^{\prime}$ which is adapted to receive the pin 3 , and there is the smme wedging action of the hell 1 with respect to the ring 5 as the partare donw together by the latel $s^{\prime}$ bemer forced down upon the pin 3 into the position shown in Fig. 6.

In the deviee of Figs. $\overline{7}$ :and 5 . the lateh
 ried by the ring 5 , is formed with a hamalle $10^{\prime}$ anid a (romis-rod 11*. Which cingureates with a yoke or Y -shaped member 13 sedmed to the hell 1. to wedge the hell within the ringe or the surfiace of the yoke $1: 3$ having a "ann adtion with respert to the wors rod $11^{*}$.

The smatl emt of the section of mat he miter to the nipple bo of the somm low by ally : shitable fle vible commedion. hat 1 prefin 10 Ince a hollow or tululat hall and -ncket joint or conplinge 11. In the stmeture in Fig. 1, this compling lite tightly unom the nipple 1 : and - lide frewly "thin the lower rud of the sextion I.
 (1) Taph "arringe a' is of slightle ditheme limen. nowl the nipple le "f the somed has

 (0, mbling 11 mar ha intwral with the sertion

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 -2
 Imetion of the - mint how with the lame.
 1 cham in:



miting the same comprising one or more pins carried by the end of one section and adapted to be inserted in openings formed in the cther section, a pivotal latch carried by one section and adapted to engage a projection carried by the other section, said latch and projection being so formed that their engagement draws the sections together with a wedging action. substantially 0 as set forth.
2. A phonograph horn comprising a pair of separable sections at least one of which has a tapered engaging surface. and locking means therefor comprising a latch piroted 15 to one of said sections. and a pin rigid with the other section. said latch being formed with a cam surface for engaging said pin and drawing said sections together with a wedging action. substantially as set forth.
of separable sections, a stiffening ring applied to the end of one of said sections, a projection rigid with the other section, and a latch piroted to said ring and adapted to 25 engage said projection for drawing said section and ring together, said latch and pro-
jection being so formed as to exert a wedgelike or cam action on each other during the pirotal movement of the latch substantially as set forth.
4. A phonograph horn comprising a pair of separable sections, a stiffening ring applied to the end of one of said sections and provided with pins and with a notch, the end of the other of said sections being provided with openings adapted to receive said pins and with a projection rigid therewith adapted to be receired by said notch, and a latch piroted to said ring and adapted to engage said projection for drawing said pin 40 into said notch and thereby drawing said section and ring together, said latch and projection being so formed as to exert a wedge-like or cam action on each other during the pirotal morement of the latch, sub- 45 stantially as set forth.

This specification signed and witnessed this 30 day of March. 1908.

> PETER WEBER.

Witnesses:
Frank D. Lewis, H. H. Drкe.


# UNITED STATES PATENT OFFLCE. 

## FRANK L. DYER, OF MONTCLAIR, AND FRANK D. LEWIS, OF ELIZABETH, NEW JERSEY, ASSIGNORS, BY MESNE ASSIGNMENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

## PHONOGRAPH.

1,010,355.
Specification of Letters Patent. Patented Nov. 28, 1911.
Application filed June 19, 1909. Serial No. 503,235.

## To all whom it may concern:

Be it known that we, Frank L. Dyer, a citizen of the United States, and a resident of Montclair, in the county of Essex and
5 State of New Jersey, and Franik D. Lewis, a resident of Elizabeth, in the county of Union and State of New Jersey, have made a certain new and useful Invention in Phonographs, of which the following is a de10 scription.

Our invention relates to phonographs, and the objects thereof are to provide a novel and effective mounting for a phonograph horn or sound conveyer used in con-
lieferring to the aceompanying drawings 25 forming part of this specification in which corresponding parts are denoted thronghont by the same reference characters, Figne 1 represents a front eleration of our improwed calonet having a phonograph and hom 30 momedted therein. Fig. 2 iepresents a side elevation of the lower part of the cabinet or supporting means therefor, the upper portion of the cahinet heing shown partly in section on line 2-2 in Fig. 1, and Fig. 3 nection with a phonograph or other talking machine, and to provide an improved cabinet for a phonograph or talking machine having the horn mounted as herein described entirely inclosed therein.

Other objects of omr insention reside in the combinations of parts and constructions of details as hereinafter described and particularly pointed ont in the appended claims. is a detail showing the method of momiting the hom in Fig. 2, the same being an cmed view of the lom with supporting munns.

Referring to the dratwings, the phonograph 1 is represented conventiomally as being provided with the mandrel 2 and a reprochecer 3 momited on the trateling arriage 4 us is common. These purts me monnted on the "pper side of the top 5 of the eablinet ( 5 . Tho phenegraph motor is inclosed within the ansing 7 , which may be seemed to the lower side of top member os, or my other suitable phee in why empenient manmer. 'The phomgruph it may he conered ly the memovate cower 8.

Thos casing ore calsinet 6 moly ho of any suitable design, mut ws wo have shown it, is momed mpon the colmmens? which riso
from the top of the casing 10, whicl may, if desired. be provided with drawers 11 for holding the phonograph records. The front of cabinet ( j may, if desired. be provided with a grille or fret work 12 . by means of which the inclosed horn may be concealed while at the same time the somds issming therefrom are allowed freely to pass throngh the said grille or fret work:
The somend conveyer 13 is comnected to the neek of the reproducer 3 by a telescoping connection 14 of well known character, the some conveyer 1:3 preferably extenting rearwardly from the reprolucer 3, as shown at 15 , thence downardly by bend 16 , and thence forwardly again in part 16, which extends in substantially a horizontal direction throngh the inclosing caloinet 6 from back to fromt, this part constituting a somme amplifying hom of suitable shape and dimensions and terminating preferably in a bell-shaped month is just behinit the grille 12.

The horn 17 and somad combered 13 formed integral with or commeded inereto are momed to rutate to a sullicient extent about a fixed axis at right angles (o) the path of travel of the haveling carriage of the phonegrapha the telemeping commedion 11 rising or falling with the tratel of the car riage in whe or the other diredton, as He forwardly disected month portion of the horn thris ubout its pison. P'referalul. the axis about which the hom swime as de seribed is the axis of symmetry of the for wardly direeted monti pertion is of the horn. This piowtal mombing may be por rided in 11 number of ways. $A$ shom $n$ in the dranings, ther rod $19{ }^{\circ}$ is mombed with one chal thereof supported at the reme of cabinet is by backet $\because 0$. The end of the and is rotutubly sulpurted by harkert 20 in ams mituble manner, as lie ball hearing
 the formardly dinedial portion of the horn and proceds invially therethromer, hempr bent downworlly as shown at 2t emmelt ately in frome of the memth is of the hotion 100 the iertical portion 23 of the roul 19 a pror - ided hoing rigilly supported hes the hathet E. T. The harizantil portion of nion $1: 1$ pasem Choogh a ring or similar suitable hating

25 , which is supported axially within the horn 17 by arms 26 .

Having now described our invention, what we claim and desire to protect by Letters

1. In a derice of the character described, in combination, a trareling carriage, a reproducer thereon, a sound conveyer connected to the neck of the reproducer, said conveyer having a substantially horizontal mouth portion, and pirotal means for supporting said conveyer to permit movement of the same about the axis of the horizontal portion, substantially as described.
2. In a derice of the character described, in combination, a traveling carriage, a reproducer thereon, a sound conreyer connected to the neck of the reproducer, said conveyer having a substantially horizontal mouth portion, and a substantially vertical portion, said conveyer being connected to the reproducer by a telescoping joint, said conveyer being pirotally mounted about the axis of the mouth portion thereof, substantially as described.
3. In a derice of the character described, in combination, a traveling carriage, a reproducer thereon, a cabinet on which said parts are mounted, a sound conveyer extending from said reproducer into said cabinet and extending formardly therein, and means for supporting said conveyer to permit movement thereof during the travel of said carriage about a stationary approximately horizontal axis. substantially as described.
4. In a derice of the character described, in combination, a traveling carriage, a reproducer thereon. a cabinet on which said parts are momited, a sound converer extending from said reproducer into said cabinet and extending forwardly therein, and means for supporting said conveyer to permit movement thereof during the tra rel of said carriage about a stationary axis extending at right angles to the path of the traveling carriage, said conveyer being joined to the
reproducer neck by a joint permitting movement axial of the said neck between the neck and the adjacent end of the conveyer, substantially as described.

5 . In a device of the character described, in combination, a traveling carriage, a reproducer thereon, a cabinet on which said parts are mounted, a sound conveyer extending from said reproducer into said cabinet and extending forwardly therein, and a rod extending axially through the mouth portion of the conreyer, means for supporting said rod, and means for pivotally supporting said conveyer on said rod, substantially as described.
6. In a device of the character described, in combination, a traveling carriage, a reproducer thereon, a support on which said parts are mounted, a sound conveyer connected to said reproducer and having a mouth portion extending forwardly therefrom and a rod extending axially through the mouth portion of the conreyer, means for supporting said rod, and means for piv- 7 otally supporting said conveyer on said rod, substantially as described.
7. In a device of the character described, in combination a controlling carriage, a reproducer thereon, a cabinet haring a sup- 7 port on which said parts are mounted, a sound conreyer extending from said reproducer into said cabinet and extending forwardly therein, and means for supporting said conveyer to perinit movement thereof during the travel of said carriage about an axis extending at right angles to the path of the traveling carriage, said conveyer being joined to the reproducer neck by a joint perinitting movement between the neck and 8 the adjacent end of the conveyer.

> FRANK L. DYER. FRANK D. LEWIS.

Witnesses:
Dyer Smith,
John M. Canfield.
H. G. WIEDER.

SOUND REPRODUCING AND RECORDING INSTRUMENT,
APPLIOATION FILED DEC. 18, 1909.
1,011,298.
Patented Dec. 12, 1911.


# UNITED STATES PATENT OFFICE. 

HENRY GEORGE WIEDER, OF LONDON, ENGLAND.

SOUND REPRODUCING AND RECORDING INSTRUMENT.

1,011,298.
Specification of Letiers Patent. Patented Dec. 12, 1911.
Application filed December 18, 1909. Serial No. 533,772.

To all whom it may concern:
Be it known that I, Henry George Wieder, a subject of the Emperor of Aus-tria-Hungary, residing at 17 Lanark Man5 sions, Shepherds Bush, London, in the county of Middlesex, England, have invented a new and useful Improvement Relating to Sound Reproducing and Recording Instruments, of which the following is a 10 specification.

This invention relates to improvements in sound reproducing and recording derices such as gramophones, phonograplis and the like, and especially relates to the sound box 15 and tone arm employed in such devices.

The main objects of the invention are to improve the swivel connection of the sound arm which carries the diaphragm, to provide improvel support for the carrier of 20 the diaphragm lever and needle and to provide an it proved resilient momnting for the element which carries the diaphragm and needle smpport.
The invention further consists in pirot25 ally connecting the portion of the somed pije which carries the somen brex to the rest of the soment pipe in such a manner that the two portions of said somed pipe are coaxial at the joint in their nomal working
30 position, and whereby the gradmal taper of the somml pipe may be contimed to the sound box itself.

According to another part of the insention the neadle carrier and diaphagm are
35 monnted on a har having two projecting knife edged arms bearing in sulable grooves formed one on a pin extending from the somed bex, and the other on a pin carried by a brackect altached to said somme 40 box. sail knife edges and their comer sponding erooves bring oppositaly formed with resperet to each of lier, ant so arranged that the movement of the record agrainst the needle femts to hold the bar more firmly in

The invention further ©
 ment upon the end of the somm thibe resili rolly in silch a mamere that it ma! Howe ferential divertion lout may bot mote ont of its memand plane. By. this methoul wf mom! ing the contire movement of the nerelle in Hne direction which niferds the dianhragm
55 is trmsmitted to the diaphragm instond of somes of the mosement living absorthed in moving the dimphagm carvief out of its
proper plane as occurs in apparatus of this character at present in use.
The invention further consists in an in:- 60 proved diaphragur for sound reproducing and recording instruments consisting of a thin disk of woorl, composition or the like with a circular flange or ridge some distance within the periphery, the portion of the diaphragm within this flange or ridge being thickened.
Referving now to the drawings:-Figure 1 is an elevation of a somnd pipe having a continual taper; Fig. 2 is a part section of Fig. 1, slowing my improved swivel joint: Fig. :3 shows an cularged riew of my improved needle mominting: Fig. + is an eleration of my impron ed diaphagen carringr clement will part of the back cover removerd; Fig. a is a section on the line ( ${ }^{(1)}$ of Fig. t: Fig. is is a section on the lime D-I) of Fig. t. Fig. (i is a section thromgh my improwed diaplaragm.
Accorcling to the first part of my invention and in order that the somed pipe a 11 ay be formed with a contimal taper from where it joins the entimement b, to the hack phate of of the diaphragm camper h. Fig. . When aportion of it is :rrathed with a swisel joint. I armange the larye emel of the diaphrag carrying mertion $k$ of the somend tulse $\overline{4}$. so that it mily he con-axial in How working position with the part of the pipe ato which it is pisoted and I arrange the ends sit that they make a sorken juint. This maty be done be fominge on the comb of

 right :mgles to the an $\begin{aligned} & \text { is of of the jointal and }\end{aligned}$ of the pipe. This exlimbrimel pertion in






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 timis.

When fle deviee is mranged in an antinet.
an additional joint as shown at $p$, in Fig. 1, of any convenient construction may be prorided in order that the diaphragm carrier $h$ may be swung out to a conrenient po5 sition for adjustment.

According to another part of the inrention the bar $q$, or the like, Fig. 3 which carries the diaphragm lever $r$. and the needle holder, is provided with two projecting knife edged arms $t$ and $u$ adapted to bear in groores on the ends of the pins $v$ and $u$. The knife edges $t$ and $u$ are arranged in opposite directions as shown, the one, $u$, on the side of the carrier $h$. toward which the
15 record moves (the direction of rotation of the record is shown by the arrows in Figs. 2 and 3) being arranged with its edge toward the record, the pin $w$ in which it bears being carried by a bracket $x$, while the other
20 knife edge $t$ is arranged in the opposite direction and bears upon the pin $v$ projecting upon the diaphragm carrier $h$. The knife edges are preferably held toward their bearings by screws $y$, $z$. with interposed springs.
25 By arranging the knife edges in the above mentioned manner it will be seen that the contact of the needle with the record while the latter is running tends to press the knife edges more firmly upon their bearings in-
30 stead of tending to lift them against the resistance of springs as occurs in the usual form of instrument. High notes are by this means more satisfactorily reproduced since chattering of the bearings is aroided, and may oceiv is er fy redued in that the brations caused by scratching are not trans mitted to the diaphragm. In place of the coil springs shown plate springs may be 40 used if desired.

In the furthier part of the invention relating to the resilient mounting of the element which carries the diaphragm upon the member 3, orer which slips the portion $k$ circula soop and in the adjucent face of the back plate s of the diapliragm carrying member $h$ I form a similar groore 6 . Within the groove 4 of the member 3 are
50 two projections 7 which extend into the groore 6 of the adjacent member 5 . Similar projections but in different positions are forined in the groove 6 of this member 5 . These may conveniently take the form of
55 screvss 8 , which pass through suitable slots in the members 3. These screvs are preferably surrounded by a sleeve 9 of resilient material such as rubber. In the grooves 4 and 6 are spring buffers 10 such as rubber.
60 The projections 7 , on the member 3, bear against the one set of ends of the buffers 10 or the like, while the screws 8 on the other member 5 act as buttresses for the other ends
of the buffers 10 . The tro members, 3 and 5 , are clamped together face to face by a ring 11 , or the like, so that they cannot move toward or away from one another although they may have some small rotary movement relatively to one another against the resistance of the resilient buffers 10 . In consequence of this device when the needle is in use a certain amount of yieldingness is afforded to the needle carrying member 5 in a circumferential direction about an axis passing centrally througl or parallel with the diaphragm 12, although movement of the needle carrying member 5 , in the direction which the needle tends to move in deflecting the diaphragm 12, is prorided.
In constructing a diaphragm according to 80 this invention a disk of wood 12 is prorided some distance within its periphery with a circular concentric flange, 13 , or ridge, which prevents warping of the diaphragm by atmospheric changes and the 85 like. The portion of the disk 12 , within the ridge or flange 13, is preferably made somewhat thicker than the rest of thie diaphragm. It is found that a wooden diaphragm of this character may be used for a long period without warping and the sounds reproduced by it are of an exceedingly mellow tone. Instead of enploying wood, homever, for the diaphragm, other non-metallic material or compositions, such as "Gallalith" (whicl 95 consists of carbon, milk and potato or the like) may be used.
It will be seen that many modifications may be made in the method of carrying this in rention into effiect without in any way 100 departing from the spirit of the same.
What I claim as my invention and desire to secure by Letters Patent, is:-
In a soind reprodncing instrument the combination of a needle carrier: a bar car- 105 ried by said carrier and provided with a bearing at each end; abutments on opposite sides of said bar with which said bearings contact, said bearing and abutments being so arranged that the action of the traveling record on the needle will tend to force each bearing into a firmer contact with its abutment; a spring for each bearing tending to force the same into contact with its abutment; means for adjusting the tension of 115 said spring; and a diapluragm coacting with said carrier provided with a thickened central portion and a flange extending out from said portion, substantially as described.
In witness whereof I hare hereunto set 120 my hand in the presence of two witnesses.

## HENRY GEORGE WIEDER.

Witnesses:
Alfred G. Bratton.
E. Laiwrence H. Elliott.
E. E. CLEMENT.

METHOD OF RECORDING AND REPRODUCING SOUNDS OR SIGNALS.
application filed nov. 14, 1905. renewed mar. 22, 1910.
1,011,322.
Patented Dec. 12, 1911.

Fig. 1.


Fig. 2.


28itnesses
dames AMMan

## E. E. CLEMENT.

METHOD OF RECORDING AND REPRODUCING SOUNDS OR SIGNALS.
APPLIOATION FILED NOV. 14, 1905. RENEWED MAR. 22, 1910.

## 1,011,322.

Patented Dec. 12, 1911. 2 SHEETS-SHEET 2


Inventor

# UNITED STATES PATENT OFFICE. 

EDWARD E. CLEMENT, OF WASHINGTON, DISTRICTOFCOLUMBIA.

## METHOD OF RECORDING AND REPRODUCING SOUNDS OR SIGNALS.

1,011,322.<br>Specification of Letters Patent. Patented Dec. 12, 1911.<br>Application filed Novembe: 14, 1905, Serial No. 287,328. Renewed March 22, 1910. Serial No. 551,012.

## To all whom it may concern:

Be it known that I, Edward E. Clement, citizen of the United States, residing at Washington, in the District of Columbia, 5 have invented certain new and useful Improvements in Methods for Recording and Reproducing Sounds or Signals, of which the following is a specification, reference being had therein to the accompanying 10 drawing.

My invention relates to methods of recording and reproducing sound, and has for its object the improvement of such methods.

Briefly stated the invention consists in the
15 use of a steel disk or cylinder upon which a magnetic spiral record is traced with the variations due to speech or other somnd extended laterally thereon.
The recorder may be either a permanent
20 magnet or an electromagnet and the reproducer is preferably an electromagnet connected to a telephone receiver.
By the use of my method it is possible to make a uniform trace and produce a maxi-
25 mum magnetic effect. The disadvantage of previous methods has been that they depend upon variations in the magnetic strength, so that no matter how strong the electromagnets employed, the reproduction would
30 be weak because it wonld represent only the variations.
A form of apparatus with which my invention may be practiced is illustrated in the accompanying drawings in which-
Figure 1 is a plan view of the device with a permanent magnet for the recorder, parts beng shown in section. Figg. 2 is a side view of the same with parts in sertion. Fig. 3 is a side view of the satue with an clectro-
40 magnetie recorder. löig. 4 is a side view of the device slowing the magnetio reprotheor. with its cirenit comections.
Roferring to the dratwings I mpresents a box or calsing with any suituble driving
45 mechunism, such as a ilork train, which forming un part of my invention is mot showns. Tha man arbog of driving shat 3 of said mechanisun projects vert ically from the ensing 1 and is provided with ant minadlapted to west. 'The disk 5 is serented for rotation by a screw-eかり or thamb mut is which congages the shanfe? mul presoms against the upper fure of said diak 5 .
ing mechanism, so as to be driven a partial revolution for every revolution of the shaft 3 , is a lateral screw shaft 7 . The screwthreaded portion of the shaft 7 engages a bifurcated and threaded lug 8 which projects through a slot $2^{a}$ in the top 2 and carries the shell 9 of the recorded T provided with the usual mouth-piece 10 and diaphragm 11, which in this instance stands at right angles to the disk 5 . The slot $2^{3}$ is provided with button-hole openings $2^{b}$, which permit ready remoral of the hug $S$ from engagement with the screw shaft 7 . Rigidly secured to the diaphragm 11 is a permanent magnet MI having one pole 12 in engagement with the upper face of the disk 5 , and the other pole 13 in engagement with the disk 5 immediately below the pole 12, so that the lines of magnetism will be directly through the plate.

In Fig. 3 I have shown an electromagnet 14 energized by a source of current $\mathbf{N}$, and provided with a soft iron core 1.5 throngh which extends a rod 16 bearing against the disk 5 , and connected to the diapliragm. A frame 19 is secured to the shell 9 and supports the magnet 14 in proper relation to the disk 5.

In the operation of the recording device the slaft 3 is miven motion in the proper direction and the message or signal deliycred to the diapliragm 11 so as: to vibrate it. thus moving the mignet back und forth ower the disk, which having a rotary motion reecives a mughetio trues The mender heing fed steadily forward by the sotew mukes the trace a spiral.

For reprodncina, lle spival trace may be cansed to give motion mechanieally: © . light magnetic bodye utherhed to an liin dia. phaticm ufter the imatmer stown in Figas 1 and? or an clectronamit reprohtere may. be employed iss shan in in lig. I, this methond being prifermed. In lige: I the eledromagr net ${ }^{2} 0$ of the remodnere is shown connerm
 This ciratit commetion mat be uranged in
 athil slanpest somas in the meriber. The puld piene of the vectronaghet is pimber or rommaded mul as the combinas montion of the dish is and shaft a maintains the poime of the magne in the stanty yinal line fol lowned log the rembler, the magntio thate in its rectasion from mind uppronch to the 110
pole piece will produce varying magnetic effects in the magnet and thereby in the receiver.
The record may be removed from the disk mention the substitution of a cylinder for the disk, which, however, must be so arranged that the vibrations of the recorder will be at right angles to the direction of motion of the surface, or in other words that 5 the tracer will more back and forth along one element of the cylinder.
Haring thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The method of recording and reproducing speech or signals, which consists in impressing upon a magnetizable body magnetic waves or undulations of constant strength in a path of variable direction and a magnet, rarying the place of action so as to form on said body a rarying trace of magnetism having approximately constant strength, and finally subjecting a second angetizable body, which is connected to a sounding derice, to the action of said wary magnetic trace.
2. The method of recording and reproducing speech or signals, which consists in subjecting a magnetizable body to the action of a magnetic body, moving said magnetizable body relative to said magnetic body, moving said magnetic body relative to said magnetizable body, whereby the magnetic
50 body is caused to leare a wary trace of consequent poles of magnetism of constant strength, and finally subjecting a receiver
magnet to the action of said wary trace of magnetism, whereby it will be caused to vibrate a diaphragm.
5 . The method of recording and reproducing speech or signals, which consists in impressing upon a magnetizable body magnetic waves or undulations of substantially constant strength in a path of variable direction, exposing a relatively fixed magnetizable body to said undulations and causing the electromagnetic changes produced in said body to be electrically communicated to a telephone receiver.
3. The methor of recording and reproducing sound which consists in (1) impressing upon a magnetizable record body a continuous magnetic trace of substantially constant strength but following an undulatory path corresponding to the undulations of the sound by which it is produced; (2) maintaining the pole of an electromagnet in close relation to the surface of the record body while producing relative motion or travel between the two so as to carry the magnetic trace past the magnetic pole continuously along a fixed line, whereby the sereral undulations of the magnetic trace will successively approach to and recede from the magnetic pole, producing electromagnetic changes therein and corresponding electrical changes in the magnet windings; and (3) translating said electrical changes through suitable apparatus into atmospheric waves corresponding to the original impressed undulations.
4. The method of recording sound which consists in causing sound wa res to effect compound relative movement between complementary magnetic bodies, one of which is at a higher magnetic potential than the other so as to produce thereon a continuous magnetic record of substantially constant strength or intensity, extending in a path having undulations corresponding to the undulations of sound by which it was produced.

In testimony whereof I affix my signature in presence of two witnesses.

## EDWARD E. CLEMENT.

Witnesses:
Hugh M. Sterling,
James H. Marr.
J. C. ENGLISH.

TALKING MAOHINE.
APPLIOATION FILED JULY 7, 1905.
$1,011,419$.
Patented Dec. 12, 1911. .


# UNITED STATES PATENT OFFICE 

JOHN C. ENGLISH, OF CAMDEN, NEW JERSEY.

TALKING-MACHINE.
$1,011,419$.
Specification of Letters Patent. Patented Dec. 12, 1911.
Application filed July 7, 1905. Serial No. 268,615.

To all whom it may concern:
Be it known that I, John C. English, a citizen of the United States, and a resident of the city of Camden, State of New Jersey,
5 have invented certain new and useful Improvements in Talking-Machines, of which the following is a full, clear, and complete disclosure.

My invention relates to talking machines, 10 and particularly to those parts of talking machines known as the sound reproducing and sound conveying apparatus, and has for its object to provide means for modifying the quantity of the sound reproduced by the
15 talking machine.
In talking machines such as herein shown and described it is well known that the intensity of the vibration of the diaphragm of the reproducing apparatus is always sulb20 stantially constant and variations thereof cannot be obtained by manipulation of the sound box, record, or record carrier.

My invention supplies means in connection with the sound conducting portions of 25 the reproducing apparatus which will enable the quantity of the somod passing therethrough to be varied at the will of the operator.

Briefly my invention comprises the com-
30 bination with a somed conducting tube of a talking machine, of means for reducing the amplitude of the vibrations passing longitudinally therethrongh, hy allowing firee lateral commonication between the interior and
35 the exterior of the tube, whereloy a part of the energy of the vibrations within the tuthe will escape and be absombed by ain surromeding the tube, and consoqucnitly (he anplithide of the vibrations within the fulxe will
40 be diminished, rembling in a diministeed intensity of the somed isining longitminally from the tube.

In the accompanying donwing illustrating one form of my invention: Fignte I is m side
 parts of the msual talking machome showing my invention applicel thereto. Prig. 22 is a longitudinal sectional view of the somed conducting mechanism employed in this
 view taken sulstantially mon the lime :3-3, of Fig. 2; and ligs. 4 nud 5 ore detnil views of the prits of my inventions detached from
showing the parts in two different positions relatively.
Referring to the drawing, the numeral 1 indıcates any suitable form of casing for the talking machine motor above which is rotatably mounted a turntable 2 carrying the record 3. Attached to one side of the casing 1 is an arm or bracket 4 which carries at its upper end a curved tube or elbow 5. This tube or elbow 5 is adapted to be connected at its lower end 6 with any well known or suilable form of sound conducting tube and reproducing mechanism. The upper end of the elbow ŏ is slightly reduced in diameter as indicated at 7 and provided with a bead or shoulder 8. Upon the reduced portion 7 and telescoping therewitl is mounted a short section of tubing 9 , the upper end of which is adapted to telescope with the smaller end of the amplifying horn or support 10 therefor or other continuation of the somend conducting means. The wall of the tubular section 9 is provided with one or more upenings as indicated at 11, which are preferably elongated and slightly inelined. The elongation of the holes 11 gives a large nening in the Cubular section! withont mmecessatily weakening the same and the incline of the same permits of great whtiations in the volme of sommd transuitted lomeritudinally out through the amplifying horn 10. Abont the dubular section! is plated a sleeve or shod section of thbing to which has :moneming or openings $1: 3$ thewin orresponding to the opening or opening: 11 in the short section of fulving ! S hat wrranged lomgitudinally of the fleme insead of in the inclined diredtion. The satal
 lumbar sedtom! by means of as shander or

 :mplify ing hom as indicaton at lis, and is provilad with a projection lif forming a hamiln fer rotating tlo same whint the rube!
In the ondration of the tallang machine. "hen it is desimed to whtain the full rulue

 pmition nlwnt the fubutar furtion! that
 bot when it is desimed to medice the somme. the sleere is rotuted so that the oproning 1 is
register to a greater or less extent with the openings 11. thereby allowing the column of air within the sound conducting tube to ribrate freely transversely to a greater or transmitted longitudinal ribration of the column of air within the tube and softens the sound emerging from the amplifying horn. This result is eflected, as will be ob0 serred, without in any way muflling or rendering indistinct the tones and sounds giren off by the reproducing mechanism, the modification thereof being simply one which reduces the volume of the sound without any detrimental effect.
I preferably employ two opposite openings in the sound conducting tube and its corresponding sleere, but I do not wish to be limited to this precise arrangement for other arrangements may be adopted which will produce the same effect and allow a more or less free transterse ribration of the column of air without interfering with the progress of the wares longitudinally of said column.
It is obrious that my invention may be embodied in talking machines using either records having a rertically undulating groove or records having laterally undulating groores of even depth.
IVhat I claim is:-

1. In a talking machine, the combination with a sound conreying tube haring a reduced end, of a sleere rotatably mounted on said end, and means telescoping over the said end to hold said sleere in position longitudinally, said tube and said sleeve being
perforated to permit a part of the sound carried by said tube to pass through said sleere.
2. In a talking machine, the combination with a sound conveying tube having a reduced end forming an annular shoulder, of a second tube telescoping over said reduced end, and haring a reduced outer end, a sleeve rotatably carried by the reduced end of said second tube, and means telescoping orer the end of said second tube for holding said sleeve in place, said sleeve and said second tube being perforated to permit a part of the sound carried by said tube to pass through said sleere.
3. In a talking machine, the combination with a sound conveying tube, haring a reduced upper end forming an annular shoulder, of a second tube telescoping over said reduced end and resting upon said shoulder, and having an upper reduced end forming an annular shoulder, an amplifying horn telescoping orer the upper end of said second tube and a sleere rotatably carried by said second tube and confined between the shoulder and the lower end of said amplifying horn, said sleeve and said second tube being perforated to permit a part of the sound, carried by said tube, to pass through said sleere to modify the intensity of sound issuing from said amplifying horn.

In witness whereof I have hereunto set my hand this sixth day of July, A. D., 1905. 70

JOHN C. ENGLISH.
Witnesses:
Henry Cobb Kennedy, Alexander Park.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

## J. C. ENGLISH.

NEEDLE RECEPTACLE FOR TALKING MACHINES.
1,011,420.
APPLIOATION FILED MAY 8, 1906.


## J. C. ENGLISH.

NEEDLE RECEPTACLE FOR TALKING MACHINES,
APPLIOATION FILED MAY 8, 1906.
Patented Dec. 12, 1911.
2 SHEETS-SHEET 2.


# UNITED STATES PATENT OFFICE. 

## JOHN C. ENGLISH, OF CAMDEN, NEW JERSEY, ASSIGNOR TO VICTOR TALKING MACHINE COMPANY, A CORPORATION OF NEW JERSEY.

# NEEDLE-RECEPTACLE FOR TALKING-MACHINES. 

1,011,420.
Specification of Letters Patent. Patented Dec. 12, 1911.
Application filed May 8, 1906. Serial No. 315,772.

## To all whom it may concern:

Be it known that I, John C. Evghisif, a citizen of the United States, and a resident of the city of Camden, State of New Jersey,
5 have invented certain new and useful Improvements in Necdle-Receptacles for Talk-ing-Machines, of which the following is a full, clear, and complete disclosure.
My invention relates to receptacles for
10 holding needles, and particularly to receptacles adapted to he attached to talking machines.
One of the objects of my invention is to construct a needle receptacle which will fa-
15 ciliate the separate storage of used and unused needles, and which may be easily attached to a talking machine in such a position as to be at all times accessible to the operator.
Further oljects of my invention are, to provide a needle receptacle adapted to be attached to the supporting bracket of a talking machine; to provide a needle receptacle having a readily accessible compartment for
25 the mused needles, and also a compartment for worn needles, and having convenient means for the removal of worn needles: and to provide other improvements as will appear hereinafter.
In the accompanying drawings, Figure 1 is a perspective view showing a needle receptacle constructed in accordance with this invention, secured in convenient position on a talking machine; Fig. 2 is a perspective 35 view of saill needle receptacle detached; Figr. 3 is an central vertical lomgitudinal section of said needle reeeptarle taken on the lime 3-3 in Fig. 2: Fig. 4 is a transerse wrot cal sectional view of said receptame laken 40 on the line 4-4 in Fig. 2; Fig. $\begin{array}{r}5 \\ \text { is : } \\ \text { an in- }\end{array}$ verted plan view of satid reecptacho showing the swinging dow of clasinte for the reeprtacle in its closed pusition: and Fig. If is "1 view similar of Fig. 5, but showing the 45 swinging door in its open position and the locking serew momoted.

Referring to the drawingrs, ome momber ment of this invention is shown athencod to the usmal talking machine comprisinger the 50 1nsmal motor calbinct, abowe which rewhes the nsmal turn-table a, and mom which is
 side of the motor enbined, 1 is tho nistul sup porting hacked t, havinge an !pper com th
naled to swing in a horizontal plane in said ring is the hollow arm portion $T$ of the amplifying horn. The bell portion 8 of said horn is journaled to the upper end of said ring, and is also swing in a horizontal plane. To the outer extremity of the hollow :rm 7 is attached the somed box 9, which cooperates with the record.
'The needle receptacle is preferably rectangular in shape and may be made of brace or any other suitable metal or material. Within one end of the top plate 10 of the receptacle is located an open basin or combpartment 11 wheh is preferably sulstintially semi-spherieal in order that the un- 70 used needles which it is adspted to hold, may be readily drawn therefrom. The invention, howecer, is not confined to a semispherical compatment for this purpose as the same may be of any confignation, but preferably should have a contimmens unintermpted surface from ane edere to the other in order that the needles will med mu obstrmeting arevices or chmers in being drawn therefrom. 'The wher end of the top so plate 10 of the meceptacle wontains an aperture 12 opening downwardy into a clazed compartment, the immer side of which is formed by a tanswersertabal partition 13. and the underside of which is open forming :un ontlet adapted to be clomed liw: swinging horizontal cover or down 11. 'This docer 14 is rectangular in -hape (ow conforme to the shapere of the compmament of which it forms the bothom. and is jemmaled on at ver-
 OHE of its immer comers, and is themed infwatly into the aminer has ambline the deore (a) he simmer in its wwor plames an that its immer enge la will be thath with the ontom
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the upper surface of the bar being substantially flush with the upper surface of the top plate 10. The under side of this bar is curved to conform to the upper side 5 of the bracket 4 of the talking machine, as shown in Fig. 1. Secured also by the screws $24-24$ to the outer side of the bar is a downwardly depending oblique spring plate 25 , which is adapted to be sprung ture which possess merits in themselves, yet I do not wish to confine myself to the exact receptacle herein illustrated or described,
50 but reserve the right to utilize any other form of receptacle which will perform a
similar function, provided that the same is within the scope of my invention, as set forth in the appended claims.

Having thus described my invention, what 55 I claim as new and desire to protect by Letters Patent of the United States is:-

1. A needle receptacle for talking machines arranged to be detachably supported on a talking machine bracket, a bar carried by said receptacle for maintaining it substantially horizontal on said bracket, and a spring clasp coöperative with said bar for maintaining said receptacle thus supported.
2. A needle receptacle for talking machines, arranged to be detachably supported on a talking machine bracket, a bar projecting laterally from said receptacle for maintaining said receptacle substantially horizontal on said bracket, and a spring clasp coöperative with said bar for detachably retaining said receptacle on said bracket with said bar engaged therewith.
3. A needle receptacle for talking machines, provided with a member attached to said receptacle and having its under side arranged to engage the upper surface of a supporting bracket of a talking machine, and a spring plate secured to said member and adapted to clamp the same to said 8 bracket.
4. A needle receptacle for talking machines, a bar attached to one side of said receptacle haring its under side extending obliquely of the receptacle to conform to the 8 upper surface of a supporting bracket of a talking machine, and a spring plate secured to said bar for attaching said receptacle to said bracket.
5. A needle receptacle for talking ma- 90 chines, a bar attached to said receptacle and having its under side shaped to conform to the upper surface of a supporting bracket of a talking machine, and a spring plate secured to said bar for attaching said recep- 9 tacle to said bracket.

In witness whereof, I have hereunto set my hand this seventh day of May, A. D. 1906. JOHN C. ENGGLISH.

## Witnesses:

Willer A. Holden,
Alston B. Moulton.
T. EINON.

PHONOGRAPH RECORD AND PROCESS OF MAKING THE SAME.
$1,011,421$.


## T. EYNON

PHONOGRAPH RECORD AND PROCESS OF MAKING THE SAME.

## 1,011,421.



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2003namil.

# UNITED STATES PATENT OFFICE. 

THOMAS EYNON, OF CHICAGO, ILLINOIS.
PHONOGRAPH-RECORD AND PROCESS OF MAKING THE SAME.

Application filed April 15, 1909. Serial No. $490,044$.

## To all whom it may concern:

Be it known that I, Thomas Eynon, a citizen of the United States, residing at Chicago, in the county of Cook and State of 5 Illinois, have invented certain new and useful Improvements in Phonograph-Records and Processes of Making the Same; and I do hereby declare the following to be a full, clear, and exact description of the invention, 10 such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to phonograph records or records for any similar mechanism under the head of phonographs, and it is to be understood that the term "phonograph" is intended to embrace any form of talking or somnd-reproducing mechanism employing wax or similar records.
An object of the present invention is to produce means whereby an unlimited number of records may be produced from a master record ly transferring the record prorecord.
A further object of the invention is to cm ploy a hard metal master record coated for the purpose of production only with a thin layer of wax, the wax being removed at places by the action of the needle of the phonograph and the parts uneovered by such action being etched out of the metal by ordinary etching process whereby the record is produced in the metal which is later transferred to the wax record.
$\Lambda$ further object is to provide a hard metallic record and to employ a soft metal to prodnce a negative from the hard metal mesord, which negative is adapted to reproduce the reeord upon a was body.
A further objeet of the invention is (o) provide means for employing a pemeil of heat rays for removing the was from the conted metal instend of employing a metal lie needle for mechanimally remoring stach wns.

A further object of the invention is to prosvide ma apparntus udapted to cmploy the wax-covered homed metal and th moric the snome in pusition for being neded upon by the phongeraph and hater to transfor the reword from sinch metal to a soft metal, from which the recored is fimally producent.

With these nud other objects in view, the
invention comprises certain novel constructions, combinations and arrangeinents of parts, as will be hereinafter fully described and claimed.
In the drawings:-Figure 1 is a view in 6 side elevation of an apparatus for carrying into effect the present invention, and showing the wax covered metal ribbon being operated upon by the phonograph. Fig. 2 is a view in side cleration of the mechanism showing the completed master record ribbon being run through a machine when associated with a soft metal ribbon to produce the negative. Fig. 3 is a vertical. sectional vien throngh the rolls of the devices ns on line $3-3$ of Fig. 1. Fig. 4 is :1 top plan view of the rolls with part of the frame-wnek broken away as on line $4-4$ of Fig. 1. Fig. 5 is a view of part of the frame-work in side clevation. Fig. 6 is a transuerse sectional view through the bed and hom sumporting member as on line 6-G of Fig. 1. Fig. 7 is a transwerse. sectional riew of the bed as taken on line $7-7$ of Fig. 1. Fig. S is an cularged view in side elevation of the phonorraph needle engaging the master reenoll ribbon. Fig. 9 is a conventional view in side elewntion showing the employment of the simis rays and a hmong ghass (o) remore the wis. from the master terord ribbom. Fig. 10 is a view in side elevation of $n$ roller emphened for transferring the record from the master record to the negative lige 11 is a viow in
 etched with three recomds. lige. 12 is a vew in transwerse seedion of one of the magatives with three revords bans fermed thereto. VFig. 13 is a riew in phat of either the masan wer wat ribhon shown at F゙ier 11 or the merative shownat Mír. 12. V"ir. 11 is a 1 iew ill emb devation of a combontional means for trans Ferring the momed from the nerative to a wis cylinder. Fige ith is a view in side che bation of the trans ferving manas shown ot lify. 11. Fig. 16 is a comomiomal view of ant mpatatus for transforinge the reond from the magation to a disk reword.
Like chataders of referemen indiater comreponting parts Homghont hee soreral 1 iens.

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$\qquad$
a roll or drum 21, from which it is mored through a groore 22 in the bed 23 . Such movement is accomplished in any approred manner as by a roller 24 carried upon a shaft red the 33 in connected with the bed 23 , in any approved manner. The frame-work 24 is bifurcated as at 27 and bearing blocks 28 mounted therein morable rertically. Within the bearing blocks 28 a shaft 29 is journaled carrying a roller 30 having flanges 31 adapted to engage upon the opposite ends of the roller 24 and with a circumferential groove 32 , so formed that the roller 30 will bear only upon edges of the ribbon 20 . The shatt 25 is protided with any approred means for rotating the same here shown as the crank arm 33 , so that as the crank arm 33 is rotated the roller 24 rotates therewith and rotates gagement by means of springs 34 and tension scretrs 35.

Above the bed 23 a horn, shown conrentionally at 36 , is mounted, haring the usual sockerary daphragm 37 carrying a socket member 38 shown in detall at Figs. engaging the upper surface of the ribbon 20 or an arm 40 having a refractory disk 41
30 secured thereto provided with a central aperture 42 abore which a burning glass 43 is mounted in such manner that the rays concentrated by such burning glass are directed through the aperture 42 upon the wax surthe mer the ron the to sound wares within the horn 36 will more the needle 39 or the arm 40 and disk 41 transtersely of the ribbon 20 , so that the from the burning glass 43 impinging upon the max surface of the ribbon will cause the wax film to be remored from such ribbon in a waved line as shown conventionally in Fig. 13 at 44.

It is obrious that the position of the needle or clisk 41 relative to the transwerse extend of the ribbon 20 may be raried so that more than one record may be produced upon the desired, and as shown at Fig. 13 it being understood, howerer, that the number of records so produced is not limited and may vary from one to any number that the width of the ribbou will accommodate.

After the ribbon 20 passes between the rollers 24 and 30 with the record formed in the soft wax of the film, it is passed through a rat or bath 45, shown at Fig. 1, such rat containing etching acid, whereby the sur-
60 face of the metal not covered by the was is etched out, after which the ribbon is run through a rat or bath $45^{\prime}$, containing a washing material which will neutralize the acidity of the etching bath, which may also
later by heating the ribbon, as found most conrenient. As the ribbon runs through the bath $45^{\prime}$ it is preferably wound upon a roll 47 for storage purposes.

After the wax has been removed from the ribbon it is found that the record produced on the wax film has been faithfully reproduced in the surface of the metal itself, as shown at 44 in Fig. 11, so that the record is in the form of groores of irregular serpentine shape formed in the surface of the metal.

It is desirable to produce the record for ordinary use in the surface either by wax cylinder or wax disk, but as the groove in the ribbon 20 would produce upon the wax an ripstanding rib, it is found necessary to produce a negative. For this purpose a roll 46 is placed as shown at Fig. 2, and the etched ribbon 20 again run through the groove 22 of the bed 23 . Nom, homever, the horn 36 is preferably remored, and the soft metal ribbon 47 is unwound from a roll 48 and passed through the groore 22 , simultaneously with the ribbon 20 . Now the roller 30 is remored from the frame-work, and a roller as shown at Fig. 10, substituted having a plurality of circumferential ribs 49, the end portions $31^{\prime}$ corresponding with the ends 31 of the roller 30. The roller shown at Fig. 10 is made to bear $\pi$ ith a considerable degree of pressure upon the soft metal ribbon 47 at those places mhere the record on the ribbon 20 is disposed. With the derice as shown herein with three records upon the ribbon 20 , a roller with three of the ribs 49 will be employed whereby in use three groores 50 are formed in the contacting surface of the soft metal ribbon 47 forcing contiguous portions of the soft metal into the groores $44^{\prime}$ as shown at Fig. 12, after which such soft metal ribbon is wound upon a conrenient roll as 51 , for storage purposes. It will be understood that the soft metal ribbon provided with the upstanding ribs $44^{\prime}$ will be a faithful negative of the record produced in the metal ribbon 20. Now, if the regative 47 is passed over the surface of a wax cylinder 52 , as shown conventionally at Figs. 14 and 15, and at the same time tension exerted thereon in any approred manner as by a teusion roller 53 , the record as produced in the wax film of the ribbon 20 will be reproduced in the surface of such wax cylinder. If a max disk is to be employed as shown at 54. in Fig. 16, with a tension roller 55, the record will likewise be transferred from such ribbon 47 to the wax disk. It will be understood, of course, that mechanical means must be employed for properly moving the negative 47 or the disk or roller 54 or 52 relative to each other, so that the record will be produced on such cylinder, for instance, as shown at 56 in Fig. 15. Any of the usual and ordinary mechanism for
moving the parts now employed upon phonographs may be used to advantage in carrying out this part of the invention.

What I claim is:-

1. The process of producing a phonograph record consisting in passing a coated metal plate adjacent to a vibrating diaphragm provided with means for removing a portion of the coating, passing such metal through an etching bath, transferring the record formed by the etching to a soft metal, and transferring the negative from such soft metal to a wax record.
2. The process of producing a phonograph 15 recold consisting in passing a coated metal tape adjacent to a phonograph diaphragm having means for removing the surface coating, passing the ribbon through an etching bath, removing the coating, passing the rib20 bon under pressure in association with a soft metal ribbon to produce a negative, passing the negative under pressure upon the surface of a plastic record.
3. The process of making a phonograph 25 record consisting in passing a coated hard metal ribbon adjacent a phonograph dia-
phragm, removing part of the surface coating by means which is carried by the diaphragm, passing the coated ribbon through an etching bath, passing the etched ribbon :: under pressure in association with a soft metal ribbon, and passing the soft metal ribbon in association with the surface of a plastic record.
4. The process of producing a phonograph 35 record consisting in passing a coated metal ribbon adjacent to a vibrating diaphragm having means for removing the coating. passing the ribbon through an etching bath adapted to etch out the metal where exposed, removing the coating from the ribbon, passing the etched ribbon in contact with a soft metal ribbon under pressure to produce a negative, and employing the negative to impress a positive upon a plastic surface.
In testimony whereof I affix my signature in presence of witnesses.

## THOMAS EYNON.

Witnesses:
C. J. Scilidade,
C. E. Martin,

William Frumel.
J. W. OWEN.

METHOD OF MAKING SOUND RECORDS AND THE MATRICES FOR FORMING SOUND RECORDS. APPLICATION FILED MAY $4,1908$.
1,011,838.
Patented Dec. 12, 1911.
3 8HEETS-SHEET 1.


Fig. $\mathbf{\text { WWWWWWWWWLS}}$


WITNESSES
Gig. Wauturaw.
attorney
J. W. OWEN.

METHOD OF MAKING SOUND RECORDS AND THE MATRICES FOR FORMING SOUND RECORDS. APPLICATION FILED MAY $4,1908$.
1,011,838.
Patented Dec. 12, 1911.
3 8HEETS-SHEET 2.


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Fig. 21.


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J. W. OWEN. METHOD OF MAKING SOUND RECORDS AND THE MATRICES FOR FORMING SOUND RECORDS. 1,011,838.

Patented Dec. 12, 1911. 3 SHEETS-SHEET 3.

Fig 29.


Fig. 30.


Fig. 31.

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# UNITED STATES PA'IENT OFFICE. 

# JAMES W. OWEN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO VICTOR TALKING MACHINE COMPANY, A CORPORATION OF NEW JERSEY. 

## METHOD OF MAKING SOUND-RECORDS AND THE MATRICES FOR FORMING SOUNDRECORDS

$1,011,838$.
Specification of Letters Patent. Patented Dec. 12, 1911. Application filed May 4, 1908. Serial No. 430,658.

To all whom it may concern:
Be it known that I. James W. Oven, a citizen of the United States, and a resident of the city of Philadelphia, county of Phila-
5 delphia, and State of Pennsylvania, have invented certain new and useful Improvements in the Method of Making SoundRecords and the Matrices for Forming Sound-Records. (Case B.) of which the fol-
10 lowing is a full, clear, and exact disclosure.
The object of my invention is to produce a commercial sound record which camot easily be duplicated or dubbed without cither impairing or injuring the sound rec-
5 ord formed thereon, or indicating the source of origin of the original record.

A further oljeget of my invention is to produce a sonnd record or a matrix from which sonnd records may be pressed having distinet from the record groove or ridge located upon the recorded portion of the remed.

A further object of my invention is to step is to form in this negrative or shemb or "pon the matrix formed therefonm identification murks, ne above deservibel umil 1 mus make surlo marks in a viricty of ways.

Referring first to Figs. 1 to 7 . Fig. 1 is a sectional view of a negative or shell 1 , 5 which has been formed from the master record as above indicated. This shell has the somnd waves formed as a narrow ridge 2 on the face of the shell, the same being a reverse of the sombl record formed in the master record. The shell 1 is preferably made of copper and is formed by copper plating the mater record in any electrobath. The shell 1 is first given a coating of a suitable material which will be readily effected by a mordant which will not violently attack the copper shell. I may form this coating by depositing over the face of the shell a thin coating of zine by the electroplating process. This coating of zinc is very thin and the ridges forming the record groove will plainly appear on the face of the zine coating. This step is illustrated in Fig. 2, iu which 3 indicates the rine coating. I then form mpon the zine coated surface of the shell letters, words, marks or other characters which it is desired to have appear npon the face of the finished matrix by coating a part of the surface of the zine with an erching-ground, as phainly illustrated in Fig. 3. The letters or marke may be former ley painting or stomeiling a proption of the zine surfface with a materint which will resist the action of $n$ memdant or the portions of the zine surface which it is decired to have appear ns matke maty be heft minproteded while the smrombling pertion of the rine may be coated with the sund atching-ground. The mproteded portion of the gine is then emten mwny or remomed and a part of the curface of the comand shell depresed by immersing the whole in al beth which will rapidly ad mon the rine coating but which will mot materintly whent the copper: I wak mold hath of sulfuric acid mats be used for this pirpores athl after hatiner been immerab for at sher time all the gine will tre womed from the surface of the copper shall exeept that which whe pro teeded by the etching gromed, as illut anted in Fige 4. The etching gromen is them row numed in muv suitahle manner as shown in Fig. s. and the shell is umited to a backing $\therefore$ in the usial mantuer her the awenting proce res. ine illuatroted in Fig. 6 mid the whone

surface 6 of nickel, as shown in Fig. 7. In carrying out this process it is immaterial whether the backing 5 is united to the shell 1 at the first or at the end of the process, etching I prably hat indicespand has been remored, as abore indicated.
My invention may also be carried out in the manner illustrated in Figs. 8 to 13, in 10 which the shell 1 has applied to the recorded surface thereof the etching-ground 4, without first plating the shell with zinc, as illustrated in Figs. 8 and 9, the shell having a part of its surface thus protected is 15 then immersed in a bath which will attack the copper and the whole unprotected surface is thus depressed for a slight distance, as shown in Fig. 10, after which the shell is remored from the bath and the etching20 ground removed (Fig. 11), then backed up by uniting it to a suitable backing 5 , as shown in Fig. 12, after which the whole may be given a suitable plating 6 of nickel to protect the surface from injury.

Instead of forming the letters or marks directly upon the face of the shell, as above illustrated and described, I may form the same upon the back of the shell. as illustrated in Figs. 14 to 20, in which Fig. 14 be provided with the zinc or other surface 3, as shown in Fig. 15. A part of the zinc surface may then be protected in like manner by a suitable etching-ground 4 (Fig. 16) will act upon the unprotected zinc coating as shown in Fig. 17. After the zinc surface has been sufficiently depressed or the unprotected portions completely remored by of the bath and the etching-ground removed in any suitable way. The shell is then placed upon a suitable backing 5 and united thereto under pressure as by the sweating process,
45 whereupon the slightly projecting zine surfaces will be pressed into the back of the shell with the result that the surface overlying the zinc coated portion will be raised slightly abont the general surface of the recand instrated ing. 19 , it being understond, however, that when the shell is united to the backing by the sweating process it is of course necessary to protect the recorded portion of the shell by interposing between ehe in and pressing plate a sheet of ehast ic protective material such as a shect of asbestos. which will prevent the ridges on the shell from beenming injured and will allow the surface of the shell overlying the viold aurl forinn of the backing to shghtly yield and form the letters or marks on the surface of the shell. As in the previously described methods the matrix thus formed may be given a protective coating of nickel.

In Figs. 21 to 27 I have shown a still further modification of my process in which the letters or marks are formed upon that surface of the backing which is adjacent to the shell. The backing is shown in Fig. 21, and upon the face of the backing I may deposit a thin coating of zinc, in the manner above described as shown in Fig. 2. A portion of the zinc surface is then protected by applying thereto a suitable etching-ground 4, as shown in Fig. 23, after which the unprotected portion of the zinc surface may be caten away by a suitable mordant, as shown in Fig. 24 . The shell is then placed upon the backing as shown in Fig. 25, and united thereto under pressure, whereupon the zinc coated portions of the surface of the backing will present slight elerations in the face of the backing which will be pressed through the thin shell when the shell is united with the backing by the sweating process, thus forming the marks upon the recorded surface of the shell, as shown in Fig. 26. The finished matrix is shown as nickel plated in Fig. 27.

In Fig. 28 to 34 inclusive, I hare shown a still further method of forming the marks upon the surface of the matrix. The backing shown in Fig. 28 is given a thin coating of zinc or other suitable material upon the back thereof, as illustrated in Fig. 29. Parts of the zinc, or otherwise coated backing, are protected by a suitable etching-ground 4 , as shown in Fig. 30, and the parts of the coating not corered with the etching-ground are depressed in any suitable manner, as by immersing in a bath of weak sulfuric acid. This step is illustrated in Fig. 31. The shell or matrix 1 is then placed upon the face of the backing 5, as illustrated in Fig. 32, and the shell is united to the backing to solder the two said parts together under pressure, with the result that the projecting portions 3 on the back of the backing are pressed into the backing and through it, and also through the thin sliell, so that that portion of the hacking which presented a raised appearance, due to the thin deposit of zinc. or-similar material upon the back thereof, appear upon the face of the shell. and. consequently upon the face of the matrix as slight elevations, as illustrated in Fig. 33. The whole may then be given a nickel plating, as in the previonsly describerl processes, this step being shown in Fig. 34.

A commercial record $T$ may be formed from any of the matrices shown in Figs. 6, 12. 19. 26, or 33: or from the nickel plated matrices shown in Figs. T, 13. 20. 27. or 34. with the result that the portions of the record groove 8 traversing the raised portion of the matrix will be slightly depressed below the $\underline{g}$ eneral surface of the record forming marks, as at 9 Figs. 35 and 36 , but the continuity of the groove or the depth or
width of the groove will not be materially changed where it traverses the said marked portions.

It is, of course, obvious that in these proc-
5 esses the portions of the zinc surface remaining after the shell has been subjected to the action of the mordant, as illnstrated in Figs. 5,11 and 18 or the zinc coating has been subjected to the action of the mordant, may
10 represent either the marks or the shrface surrounding the marks, in either case the same general cliaracteristics being present, that is to say, a part of the effective surface of the face of the shell or a part of
15 one of the adjacent surfaces of the shell or of the backing is in part depressed or in part elevated with respect to the other parts of the surface.

I prefer to form the marks upon the re-
20 corded surface of the matrix and consequently in the recorded surface of the record produced therefrom, as illustrated in the various views of the drawings and when I use the expression " recorded part or portion of the record"
25 I mean the whole or any part of the surface of the tablet or of the matrix bonnded by the beginning and the end of the record groove or rirlge including any portion of the surface of the tablet or the matrix be-
30 tween the gronves or ridges or any portion of the surface, or sides, or tops, or botoms of the grooves or ridges forming the sommel record.

For convenience I wall the marks which I 35 have formed in the mamere above described. "identification marlss" but it is olvioms that these marks may be of any desired form. shape or character, of they may be words or leters or may be provided to canse and anamental
40 effect in the face of the finished reeord any of which marks wonld fully serve to identify the reeend, as well as impart any other information which it is desired on incorporate inta : recomel to the neer of the remerd.
(6mmereial reends may be pressed diveedly form the matrices. formed in the
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50 othere malrices for the productions of comb mercial remords.

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of a pad, or stamp, or brush. impregriated with cold sulfuric acid and water. or any other suitable etching reagent or mordant. In ihis case it may not be necessary to first protect any portion of the zinc or other conting with an etching ground, -ince the reatent above described will act very rapidly upen the coating of zinc and renowe it withomt spreading it. It is also apparent that the film of zine or other material is wery thin and the zincer or other coated surface will have in it the same grooves or rideres as appeared in the uncoated matrix, and the grooves and ridges will be continums and of sulstantially the same depth. or lowight. and width on the zine surface as the have on the surface of the matrix beneath surch coating. It is also to le observer that when the face of the shell or matrix is the portion to which the zinc or other conting is applierl, the shell and backing may be miter prior to such coating and also when the marks are formed upon the back of the backing, althongly nsially it would be preforable to form the marks in the sholl or the backing as might be desired befree the same are united. since in some instances, it womld save one operation and would further preduce the liability of injury to the record of the sommd recorderl.

Inasmuch as the coating is very thin. the elevations on depressimns will be fer slight and when commercial reweds are protilel with the marke chained by eamerine wht the
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2. 'The methow of mhkine a matrir $n$ ith indentitiontion mark Hureon, whi hon it in forminer : chell, comalige mid hell with a
metallic material, forming the desired marks on said material with a protective coating, depressing that part of said material which is not protected, and backing said shell.
3. The method of making a matrix with identification marks thereon, which consists in forming a shell, coating said shell with a material capable of being etched, forming the desired marks on the said material orer
4. The methot of forming a matrix which ensists in covering one side of said matrix with a coating of zinc, protecting parts of said surface by forming the desired marks upon said surface within the area of the rethe recorded surface thereof with an etch-ing-ground. depressing that part of the said material which is not protected, and backing said shell.
5. The method of making a matrix with 5 identification marks thereon, which consists in forming the marks upon the matrix with an etching-ground, depressing that part of the matrix which is not protected by said etching ground, and backing up said matrix.
6. The method of making a matrix with identification marks thereon, which consists in forming the marks upon the recorded surface of the matrix with an etching-ground, cutting away the exposed surface of said matrix by a suitable mordant, and backing up said matrix.
7. The method of making a matrix with identification marks thereon. which consists in forming the marks upon the recorded sur-
0 face of the matrix with an etching-ground, cutting away the exposed portion of said surface by a suitable mordant, remoring said etching-ground and backing up said matrix.
8. The method of marking a matrix, 35 which consists in forming a shell, covering one side of said shell with a material capable of being etched, forming the desired marks in said material within the boundaries of planes passing substantially normal to the beginning and the end of the record groore with an etching-ground, and depressing the unprotected portion of said material.
9. The method of marking a matrix, which consists in forming a shell, covering 5 one sicle of said shell with a material capable of being etcherd. protecting parts of the surface of said material, and depressing the unprotecterl parts of the sirface of said material. corded portion of said matrix with an etch-
ing-ground, and etching the unprotected portion of said material.
10. The method of marking a matrix which consists in changing the relative heights of parts of the surface of said ma- 60 trix within the area of the recorded portion thereof to form the desired marks by an etching process.
11. The method of making a matrix which consists in forming elevated marks upon one surface of said matrix within the area of the recorded portion of said matrix by an etching process, and backing up said matrix.
12. The method of making a matrix 70 which consists in forming marks upon one surface of the matrix by a suitable etchingground, subjecting the matrix to the action of a suitable mordant, and remoring said etching ground.
13. The method of making a matrix which consists in forming upon one surface thereof the desired marks with a protective coating, depressing the unprotected portion of said surface, and backing up said matrix. 80
14. The method of marking a matrix which consists in coating the same with a metallic substance, and depressing parts of said substance.
$1 \check{3}$. The method of marking a matrix 85 which consists in coating the same with an etchable substance, and depressing parts of said substance by a mordant.
15. The method of making a matrix which consists in forming a shell, coating 90 said shell with an etchable material, changing the heights of parts of said substance, and backing said shell.
16. The method of marking a sound record matrix. Which consists in coating the 95 same with an etchable material, changing the heights of parts of said material by a mordant, and nickel-plating said matrix.
17. The method of marking a matrix which consists in coating the surface of the 100 matrix with a material capable of being etched. forming the marks upon said surface with a suitable mordant, and uniting said shell to a backing.

In witness whereof I have hereunto set 105 my hand this 2nd day of May A. D. 1908.

Witnesses:
Alston B. Modlton,
Alexavder Park.

$$
1,012,250
$$

T. A. EDISON.

## RECORDING TELEPHONE.

APPLIOATION FILED SEPT. 15,1905
1,012,250.
Patented Dec. 19, 1911.

T. A. EDISON.

RECORDING TELEPHONE. APPLICATION FILED SEPT. 15, 1905.
1,012,250.

T. A. EDISON.

RECORDING TELEPHONE.
APPLIOATION FILED SEPT. 15, 1905.
1,012,250.
Patented Dec. 19, 1911.
3 SHEETS-SHEET 3.


## UNITED STATES PATENT OFFICE.

# THOMAS A. EDISON, OF LLEWELLYN PARK, ORANGE, NEW JERSEY, ASSIGNOR TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY. 

## RECORDING-TELEPHONE.

1,012,250.
Specification of Letters Patent. Patented Dec. 19, 1911.
Application filed September 15, 1905. Serial No. 278.549.

## To all whom it may concern: <br> Be it known that I, Thomas Alva Edison,

 a citizen of the United States, residing at Llemellyn Park. Orange, in the county of5 Essex and State of New Jersey, have invented certain new and useful Improvements in Recording-Telephones, of which the following is a description.

My invention relates to telephones and whereby the electrical vibrations or undulations which are received over the line may be recorderl phonographically, whereby a reeord is formed which may be nsed in any 15 ordinary phonograph, and the message repeated at any future time.
My invention relates more particularly to that form of a telephonic reeciver deseriberd and shown in U. S. Letters Patent No.
20 221,957 granted to me ou November 25, 1879, wherein a friction wheel formed of clalk on other suitable fincly divided non-conducting material or pormis body having (apillary pores, is moistened with a suitable solution
25 such as caustic alkali and a friction member such as a flat sprimg is pressel upon the chalk with a considerable pressure, the said spring being comerted to a suitable diaphragin and the friction whed heing slowly
30 rotaterl. The line wire is comnected so that the enrent passes throngh the spring, frictional eontact and fridion wheel and cansess the amonnt of friction between the frietion member and frietion whel to bary in tre
So sponse to the electrie waves or medulations, therely throwing the diaphragm into viba: tions enoresponding thereto.

The present invention has for its objert the application of sumb atelephone mespere
43 to merhanism wherely the meedaniond viluations of the diaplasignt thes prorlued may be utilized on prodnce a phomographie reesord in the form of a helient on spiral greme and more pardicularly the supporting of the
S5 friftion where and diaphagrm on a frateling earriage, und the driving of said whent from a stationary motor used also for driving the carringe.

Refereme is hereby minde fo the necom-
oo panving drawine forming part of this specifichtion und in whinh

Figure 1 is " fromt alevation illuatrating the telephomice reesiver and weording menth minism; Fig. 2 is anl molderation of the
55 same; Fig. 3 is at detail phan view of the
telephonic receiver and a portion of the mechanism for driving the fristion wheel: Fig. 4 is a section no line $4-1$ of Fig. 3: and shows also the electrieal connentions.

In all the above views emresponding parts 60 are designated by the same reference numerals.

The reenrding surface may be a cylinder 1 of suitable material for receiving a phomographic record and the mechanism for supporting and rotating said cylinder may be similar to the parts of an ordinary phonograph comprising a tapered mandrel ? on which the eylinder 1 is held by frictiomal engagement and narried by a haft 3 supported at its end by pirnt pins $3^{\prime}$ and 4 . the later being earried by an ent gate is. s:id shaft being driven by mems of a pulloy fond belt 8 driven from any sutable somere of power, sump as a spring in electric motor:

The telephonic receiter emprorises a body ? momed upon a traveling narriage which consists of an arched member 10 whoer rear end is elampert to a sleeere $10^{2}$ slidinge on at rod 11. and whose forward end rate uporn a straight edper 12. a lift lever 12n being provided for elesating said ond. The arm 10 and sleeve $10^{n}$ are givell a progranise mowement inward the right. Fier. 1. liy : feed mit 13 carried lo a sprine sam 11 ar cured to the shene $10^{n}$ amblemgrine ateme 15 carried by or intereral with on haft tis driven fiom the main shaft 3 ly meane of
 The reeriver :lan compriows fridtion whel 20 of chalk or other suitable material, warried ont an theiver chaft no? which is jumrnalled in the wathe of the bonts? and a brackey of cermed themedn. I temen os haiving in collare $\Omega 1$ is cromed to the dinft on
 int each side of the wheet an and the whole
 (larembel on the haft w? (ore Fier. 3)
Thu fridions whed Aris ius medmem comprime a colimlrical drom on which is lived to the -haft is amp matale thementh. I drive rollow en i jumbuled :1t oum and of a cil inging urm ?n mil bartion a lural cran sh which me hes with a mimber erar
 which i- jomemaled in the urom 'The un' per eme of the bhef 3 as proviled with a worm il which elusere n 11 um whed is on the cond of the slonft In. The mom sit) is
rigidly secured to a block 36 (as by a screw $3\left(6^{2}\right)$ and said block is mounted on the shaft 22 so as to permit the latter to freely rotate. In order to provide a good frictional driving contact between the roller 29 and drum 28, a coil spring 37 is arranged between the block 36 and bracket 24 and the ends thereof engage the said block and bracket respectively, thus pressing the roller 1029 firmly against the drum 28 . It will be observed that as the carrier arm 10 travels toward the right (Fig. 1), the roller 29 will at all times bear against the drum 28 , pursuing a helical path with respect to the surdiaphragm 41 of glass or other suitable material is clamped by a ring 42 threaded within the ring 39. The upper surface of the ring 42 forms a seat for a second diaplragm 43 which may also be of glass, and the same is clamperl against its seat by a washer 44 and clamping ring 45 threaded in the ring 39. Between the cliaphragm 41 and 43 is an air space 46. The diaphragm lever 48 Those opposite end carries a recording stylus 49 preferably of sapphire and of a shape commonly used in phonographic recording. The lever 48 is pivoted the lug or mardly from the compensating weight 52 which is pivoted at 53 to a lug projecting downward from the ring 39 and is supported at its free end by a screw 54 so as to a well known manner, to compensate for irregularities in the surface or shape of the cylinder 1. Secured to the diaphragm 43 in any suitable manner is a spring arm 55 carries near its free end a small con tact plate 56 of platinum or other suitable material. The plate 56 is pressed frictionally and elastically against the wheel 20 by means of an adjusting screw 57 threaded in
50 one wall of the body 9 , and engaging a block of soft rubber 58 bearing against the arm 55, the block 58 being secured in position by means of a pin or stud 59 embedded therein and engaging a socket 60 in the end acrew 5 . The telephonic line wires 61 and 62 orer which the electric undulations are received are connected respectively to the arm 55 and shaft 22.

The message is spoken into the telephonic current induced thereby is transmitted over the wires 61 and 62 to the receiver. The main shaft 3 being driven by its motor, the arm 10 is lowered so as to bring the stylus 6549 into engagement with the surface of the
record cylinder 1 and the friction wheel 20 is given a constant rotary movement by means of the roller 29 bearing on the drum 28 and driving the shaft 22 through the intermediate gearing. The friction block 56 being pressed against the wheel 20 with considerable pressure, friction will be created which will exert a thrust upon the arm 55, thereby placing the diaphragm 43 under elastic stress. As the strength of the current passing through the block 56 and wheel 20 raries, the amount of friction will vary. Consequently, the diaphragm 43 will be periodically relieved from the thrust of the arm 55, being thus caused to ribrate in accordance with the undulations of the electric current. By proriding an air chamber 46 , between the two diaphragms as explained, and by connecting the stylus 49 to the diaphragm 41, an elastic cushion is formed which transmits the ribrations of the diaphragm 43 to the diaphragm 41, while at the same time any relatively slow and extreme morements to which the diaphragm 43 may be subjected due to abnormalities in the electric circuit, will not be transmitted, or at least completely transmitted to the diaphragm 41 and in consequence the vibrations recorded on the cylinder 1 will be more nearly representatire of sound vibrations. It the same time it will be understood that a single diaphragm may be employed, and also that the lever 48 may be connected directly with the spring arm $5 \breve{3}$, in which case both diaphragms will be omitted. The entire telephonic receiver travels with the carrier arm 10 along the surface of the recording cylinder 1 , whereby a record will be produced in the form of a spiral groove whose pitch is equal to that of the feed screw 15 , and whereby a message of considerable length may be recorded by the instrument.
Having now described my invention, what I claim as new and desire to secure by Letters Patent is as follows:

1. In a recording telephone, the combination with the transmitter and line conductors, of a traveling phonographic recording surface, a carrier novable across said surface, a phonographic-stylus and friction wheel carried by the carrier, means comprising a friction member pressing on said wheel for vibrating said stylus, and connections whereby the line current is passed through the frictional contact, substantially as set forth.
2. In a recording telephone, the combination with the transmitter and line conductors, of a traveling phonographic recording surface, a carrier movable across said surface, a phonographic-stylus and friction wheel carried by the carrier, means comprising a friction member pressing on said wheel for vibrating said stylus, connections where-
by the line current is passed through the frictional contact, and means for driving said friction wheel, substantially as set forth.
3. In a phonic apparatus, the combination rotating mandrel, a carriage morable longitudinally thereof, a shaft mounterl on the carriage, a friction wheel carried by said shaft, a rotating drum, a roller carried by said carriage and pressed against the sur-
10 face of said drum and driving connections between said roller and shaft, substantially as set forth.
4. In a phonic apparatus, a rotating fric tion wheel, a diaphragm, a friction meming againt to said ing against said friction wheel, a second diaphragm, an air chamber between said diaphragms, a phonographic recording surface. and a recording stylus in operative engagement with said surface and connected to said second diaphragm, and means representative of sound vibrations for varying the friction between the friction member and friction wheel, substantially as set forth.
5. In a recording telephone, the combination with a rotating friction wheel, a fric-
tion surface in contact therewith, means for electrically varying the friction in correspondence to sound wares whereby said friction surface will partake of amplifier ribrations and means for recording phonographically the vibration developed by said friction surface, substantially as and for the purposes set forth.
6. In a phonic apparatus, the combina- 3 tion of a rotating mandrel, a carriage morable longitudinally thereof, a shaft mounted on the carriage, a friction wheel carried by said shaft, a rotating drum, a swinging arni carried by said carriage, a friction roller carried by said arm and pressed against the surface of said drum, and driving connections between said roller and shaft for rotating said shaft from the roller. substantially. as set forth.

This specification signed and dritnessed this 14th day of September, 1903.

THOS. A. EDISON.
Witnesses:
Frank L. Difer,
Mina C. Macaminur.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents Washington, D. C."
S. C. PORTER. SOOND REPRODUCER AND RECORD. application filed yay 13 , 1911.
1,012,910.

a.b. Darhain
dlln. Baeder.

## UNITED STATES PATENT OFFICE.

STEPHEN C. PORTER, OF MARTINSVILLE, NEW JERSEY, ASSIGNOR OF ONE-HALF TO WALTER H. MILLER, OF ORANGE, NEW JERSEY.

## SOUND REPRODUCER AND RECORD.

Specification of Letters Patent. Patented Dec. $2(6,1911$.
Application filed May 13, 1911. Serial No. 626,994.

## To all whom it may concern.

Be it known that I, Stephen C. Porter, a citizen of the United States, and a resident of Martinsville, Somerset county, State of
5 New Jersey, have invented certain new and useful Improvements in Sound Reproducers and Records, of which the following is a description.

My invention relates to sound reprorluc10 ing devices and records, and particularly to records having a continuons record groove formed thereon of the laterally undulating type and the needle or stylus which tracks the said record groove and co-acts therewith
15 to reproduce the sound recorded. In such records, as commonly made, the groove is in the form of a spiral upon the surface of a record disk or tablet, the groove being of miform depth throughout its length, or of 20 slightly increasing depth from beginning to end. The reproduction of somed from a record of this character is effected by the lateral movement of the stylus, as it follows the lateral modulations of the groove. The stylus or needle which tareks sich an growe is ussually formed of soft steel, and has a conical point which ronghly fits within the record groove, when it is first positioned therein. When the reecord is rotated the
30 point of this styhs is wom away and h, hanted ley centact with the recond simp faree after the record has progressed a short dis-
 chasely. At the end of the reproduction the neede has genceally beed worn (or such inn extent that it must be fhrown away, and a new needle substituted be fore the reprodheer is nsed again. 'The wear of a needle of the chatacter refered to is sulficient (o) canse
40 the same to acenately fit within the reecord greove after probabily only a fraction of one revolation of the recold, mul the tracking of the neredte is thewertially rowred ot this preint at which the neredte completely 55 fits the gromese. 'There wean af the needle, howerer, continues as the reemed is rolutem which canses the tranking of the needter and H1e reproxhedion of the remed to berome more and more imperfad from this puint 50) th the end of the reproduction. This is sn,
 point and adjacent sidas of the roniond beme
 to descemen, an that the thicker prention of bs the needles dessernds to the level uf the up-
per surface of the recorl. That is, the diameter of that portion of the cone which is at the level of the upper surface of the record at the end of the reproduction is greater than the diameter of that portion of the cone which is in line with the upper sullface of the record at the beginning of the reproduction. because of the wearing away of the apex or point of the cone mpon the bottom of the record groove. As the record material is relatively hard and ablrasive. and the width of the groove remains the same. this results in the underentting of the needle hy the record and the formation of shoulders mon the needle. which shonlders reat mpon the surface of the record and therefore support the needte. I have verified this conclnsion by examination. moler the mieroseope, of used reproducing needles. From this point to the end of the repromestion. The point and adjacent sides of the needle embtiming to weats. the needle fits more and more loosely in the qrowe reant ing in an imperfect reprodnction. I wercome this diflienlty by the produetion of a record in which the rerord groone is of decreasing depth from begining to end to rompensate for the wear of the mode. Preferably the demence in depth of the groence is grathal and progresive from hegiminge to emed athongh olsionsly the adVantnere of my invention might be nttaned at heast in pait if the deempane in thepth of the grown from beximing to end is mot ex attly miform. The ratring depth of the Errovere dowe mot atteet the reprentaction in
 duction is dedermines antinets he the hataral mextment of the meedle. I- the needte wears awne the hearing surfore for the lower and of the same contimalls rive sor that lle pertions uf the comical surfare of the weedle "poen "hish wherwian shmblere
 contimully ri-ing, amb lla peint and conical
 tit within and perferlls trach that gramm. The memis by which aich ar mond may bo problued is not muterint to the pre ent int vention whioh i comeerned mily "ith the
 "ith the comblimution letween such areond
 uf euft ated op wher materind which is rela tiocly noft in compurian with opphise and
other hard stylus materials which are not adapted to wear to fit within the groove of a record formed of compositions of which commercial disk sound records are made.
It may be said, however, that a master rec ord is made in any desired manner, having a record of decreasing depth, preferably of uniformly decreasing depth, cut or otherwise formed thereon, a matrix is made from cate records, haring groores of a correspondingly decreasing depth, may be formed by pressing or otherwise, as desired. In the formation of the master record, the cutting
15 or recording stylus may be gradually and uniformly raised during its travel, or the pressure which forces the cutting point into the record material may be gradually decreased during the making of the record, ter may be formed in other ways. For purposes of illustration one method and means of recording in the desired mamer upon the master record will be illustrated and described.

In order that a clearer understanding of my invention mar be had, attention is hereby directed to the accompanying drawings. forming part of this specification, in

Figure 1 represents a cross section through a portion of a record disk showing a reproducing stylus or needle in contact with the record groove of the same, the needle being and record being greatly enlarged for the purposes of illustration. The record formed as illustrated and the combination of the same with the stylus shown, illustrates one orliment of my invention; Fig. 2 represents in enlarged cross section a reproducing needle co-acting with a record groove of the common type, showing the formation of shoulders upon the needle above the record groove adjacent to the center hole 4 of the record. I have shown the groove as of a conimal cross seetion slightly rounded at the bottom. althongh my invention is not limited In this specific forin of groove. Tracking surface; and Fig. 3 represents in enlarged cross section the same needle tracking the same groore as that shown in Fig. 2, at a point in the reproduction of the record. subsequent to the point in the reproduction represented by Fig. 2. Fig. 4 represents in side elevation and rertical cross section, one form of apparatus for forming the desired record groove upon a master record.

In the drawings the sound record disk or 55 tallet 1 is providect with a record groove 2 , Which, as illustrated. is of greatest depth at its begiming, adjacent to the periphery 3 of the record: the depth decreasing preferably progreswively to the end of the record the record and co-acting therewith to re-
produce the sound is the reproducing stylus or needle $\check{5}$. As stated, this needle is formed of a material sufficiently soft to be worn by contact with the record groove so as to accurately fit the same, such a material being, for example, steel. It has a conical lower end 6 , the diameter of the shaft of the needle, shown at 7 . being considerably greater than the maximum width of the groore. As shown in its position at the beginning of the record to the extreme left in Fig. 1, this needle does not fit closely within the record groove. After a comparatively short distance of tracking, however, as illustrated by the position of the needle at $5^{\prime}$, the wear of the bearing surface of the needle has been sufficient to cause the same to accurately fit within the record groore. The final position of the needle is illustrated at $\stackrel{5}{2}^{2}$. which position is nearest to the center hole of the record, and in which, as is clearly shown, the depth of the groove has decreased to such an extent as to compensate for the wear of the needle, which still closely fits within the groove. The proportions of parts shown in the figures, and the slant of the bottom of the groore, are exaggerated and are merely illustrative.

The defect which my invention is designed to overcome is illustrated by Figs. 2 and 3 , in which a stylus or needle $5^{\text {a }}$ is tracking a groore of uniform or slightly increasing depth in the record $1^{2}$. The needle is shown in Fig. 2 as laving adranced far enough along the record, so that an annular shoulder 8 is formed upon the needle, just abore the upper surface of the record by the wearing away of the point of the needle. The needle is here represented as closely fitting within the record groore, the weight of the needle being borne by the shonlders 8 , which have just been formed thereon. In Fig. 3 the same needle is represented at a later point in the reproduction of the record than that shown in Fig. 2, the weight of the needle is still supported by the shoulders 8 , but the point and sides of the conical bearing surface $6^{a}$ of the needle have been so worn by rubbing against the bottom and sides of the record groore $2^{2}$, as it fits very loosely within the same, resulting in a faulty reproduction.
It is obvious that if it were desired to have the record begin near the center hole 4 of the record disk and progress toward the periphery of the clisk, the groore nearest the center would be deepest and that nearest the periphery the most shallow.

I am aware that it has been proposed to compensate for the wear of the needle by forming a record groore of increasing width thronghout the length thereof, but this is objectionable, because, to cite one reason, a large mmber of grooves are commonly formed upon the record surface, and the
space between the same is extrentely limited． Furthermore，increasing the width of a groove necessarily increases the depth as well，if the slant of the sides of the groove
5 is maintained the same，thereby largely counter－acting the beneficial result of widen－ ing the groove as a compensation for the wear of a conically pointed needle．
In Fig． 4 is illustrated one of many forms
10 of apparatus which may be employed in re－ cording，to obtain a record groove of the desired character upon the master record， from which duplicate records are subse－ quently made in well known mauner．As there illustrated，the master blank 1 is mounted for rotation，aud is adapted to be fed toward the right，as shown by the ar－ row，past the recording needle 9 by suitable and well known mechanism．The needle 9
20 is carried by the lever 10 pivoted at 11 to the sound box 12 ，the upper end of the lever being secured to the center of diaphragm 13 in the sound box．The sound box has a neck 14 slidably mounted upon the end of a tube
2515 having a cylindrical eulargement 16 mounted to oscillate in a vertical plane upon trunnions 17，and within a cylindrical bear－ ing 18．The latter carries a short neck 19 which is joined to the end of the recording 30 horn 20 by a flexible coupling 21 ．The weight of the sound box tends to canse the same to oscillate about trunnions 17，and canse the recording needle to sink into the record blank when the latter is rerolved．
35 The depth of the cut at the begimning of the record is regulated by a sliding weight 22 upon an arm 23 secured to the neek 15 as shown．The weight 22 may be secured at any desired point，on arm 23，beyond the pivot 17，to comterbalance the recorder and give the desired initial cut．Also carried by arm 23 is a cup 24 ，above which is a recep－ tacle 25，having a nozzle 26 of a bore or opening adjustable by screw 27 ．The recep－
45 tacle 25 may be filled with fine sand，lyenpo－ dimm powder，or other fine fluid material
either granular or liquid．When the ma－ chine is started，the ralve 27 is opened to the desired extent，and a fine stream of ma－ terial is allowed to flow uninterruptedly into 5 cup 24 throughout the making of the record． This results in gradually and continually decreasing the pressure on the stylus as the latter progresses from the periphery of the record toward the center of the same，re－ sulting in the desired groove of contimally decreasing depth．As the gramular material falls into cup 24 in a steady strean，there is no harmful vibration imparted to the re－ corder thereby．Obviously，other equivalent 60 methods of obtaining the same result may be used，if desired．

Having now described my invention what I claim as new and desire to protect by Let－ ters l＇atent is：－

1．As a new article of manufacture，a sound record having a contimous record groove of gradually decreasing depth thronghout its lengtli，from begimning to end，substantially as described．

2．As a new article of mamufacture a sonnd record having a contimnons recorl groove of the laterally molulating type．the depth of which decreases progresively and uniformly from the begiming to the end 7 thereof，substantially as described．

3．As a new article of manfacture，a sonnd record having a continuons recond groove of the lateralty maluating type．the deptly of which groove decteases from the so begiming to the end thereof in such man－ ner as approximately to compensate for the wear of a reproducing stylus or nee lle when the latter is tracking the same，substantially as described．

This sperification signed and witncomed this sth dily of May， 1911 ．

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Witnesses：
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Heniry simabos．
$1,01=003$

## J. C. ENGLISH,

TALKING MACHINE.
1,013,003.

Patented Dec. 26, 1911.
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Patented Dec. 26, 1911. 6 SHEETS-SHEET 2.


J. C. ENGLISH.

TALKING MACHINE.

J. C. ENGLISH.

TALKING MACHINE, 1,013,003.

Patented Dec. 26, 1911.
5 SHEETS-SHEET 5.


# UNITED STATES PATENT OFFICE. 

## JOHN C. ENGLISH, OF CAMDEN, NEW JERSEY, ASSIGNOR TO VICTOR TALKING MACHINE COMPANY, A CORPORATION OF NEW JERSEY.

TALKING-MACHINE.
Specification of Letters Patent. Pitented I)ec. 2(f. 1911. Application filed September 2, 1909. Serial No. 515.838.

## To all whom it may concern:

Be it known that I, Join C. Exglisir, a citizen of the United States, and a resident of the city of Camden, comnty of Camden, 5 and State of New Jersey, have invented certain new and useful Improvements in Talk-ing-Machines, of which the following is a full, clear, and complete disclasure, reference being had to the accompanying dranfication.

This invention relates to certain new and useful improvements in talking machines as will be hereinafter fully described, and particularly pointed ont in the appended claims.
In the accompanying drawings, Fignte 1 is a vertical lomgitndinal, central sertion of a talking machine constructed in acourdance with this incmion: Fig. © a top plan vicw he same with the coner and wher part. remored for clearnes: Fig. 3s a pear clenation of a detail of the same: Fig. I a (o) plan view of a modifice form of motor casing which may be nsed in applying this in-
 for cleamess; Fige is a liom alevation of the rasing slom in Fig. I, lmt will the doors remmed, the top being mitterl ass before: Fig. is a lop plan viow of :1 serome modificel form of motor casing which may be used in applying this inventions. Hos top
 Fig. 7 a roplial contral, lowgitulinal sumlion ol the monlification shann in Kige. ©






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 Hac lionel of the casing.

Mounted upon the casing 1 is a tmontable or rotary record support 10 for supporting the usual disk record 11 , and armared abowe the turntable 10 in cooperative relation therewith, is the nsmal momed boa $1: 2$ or wher suitable somnd reprodncing means camping a stylus 13, adapted to coiperate with the record 11.

The somed box or somed repmothere 12 is carred by and commmmate with a Utube it which is pirotally supported lye the free smallew inner end of a hollow tappering tone arm 1.5 with which it commmintate. The onter card of the tome arme 1.5 cmes downwardly and engages rohatably in the upper free end of a downwandy extembing and downwardy flaring hollow. (omed b,acket 20, the fower and of which is provided with an whtwadly extombiner Himare 21, and is rigidly secelred to the back is of the (asing ! an is (1) reximer with on in-

 fandening devicon extembing hamery the flange. The upper cand of the hellow bracker 20 is provided wils an mpandly © ©




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the back 5 of the casing, abutting against the inner surface of the back in a horizontal line slightly below the sound conducting opening 22 through the back of the casing, the upper surface of the bottom 2 of the casing, and the side edges of the board abutting against the inner surfaces of the sides 4 of the casing. This sounding board forms
10 with the bottom of the casing and the lower portions of the sides and end of the casing. an inclosed chamber 45 beneath the souncling board, and it is considered that this inclosed chamber increases the effectiveness 15 of the sounding board. Other sounding boards, in addition to the sounding board 40 already described, may be arranged within the casing, for instance, two rearwardly converging rertical boards 46 may be losounding board 40 and the top 7 of the casing, the rear ends 47 of these vertical boards either extending through or abutting against the rear wall 5 of the casing and being ar-
25 ranged upon opposite sides respectively and adjacent to the sound conveying opening 22 in the rear wall of the casing. The forward ends of these boards are preferably beveled and abut against the inner surfaces of the
30 side walls 4 of the casing adjacent the front edges thereof respectively. A stiffening rib 48 may be secured to the upper edge of each sounding board 46. If preferred, the rertical sounding boards 46 may be extended
35 for their full lengths to the bottom of the casing, and the inclined board 40 may be tapered rearwardly in width so as to extend only between the rertical boards. An inclosed chamber 49 is formed by each of
40 these vertical sounding boards 46 between the sounding board and the adjacent side of the wall 4 of the casing, and above the downwardly inclined sounding board 40, and the action of the rertical sounding bords is similar to the action of the domnwardly inclined sounding board 40 in amplifying and deflecting the sound waves transmitted through the machine.

In the above described embodiment of
50 this invention, the motor or actuating mechanism of the machine is suspended in a sound conduit 50 formed by the sounding boards 40 and 46 and by the cover 6 of the casing, and this conduit is in communica-
55 tion with the somnd reproducer 12 through the opening 22 in the rear wall of the casing, the hollow bracket 20 , the tone arm 15 and the U tube 14.

In the operation of this form of the in60 rention, the sounding boards and the cover or top of the casing forming the walls of the conduit 50, act to amplify and to deflect the sound waves, which are transmitted and delivered from the reproducer 12 through
front of the casing 1 may be opened outwardly to any extent desired to rary the intensity of the sound issuing from the casing, or to deflect it in any desired direction, but the doors may obviously be omitted if preferred, and the front of the casing left permanently open.

The casing used in applying this invention may be modified from that described abore, by constructing the casing as shown in Figs. 4 and 5 with rearwardly converging side walls so that in top plan riew, the casing will taper rearwardly in width, the top 6 and bottom 2 of the casing being left parallel and doors 7 being used if clesired, to form the front of the casing, as heretofore described. A downwardly and forwardly extending sounding board 56 corresponding in function to the sounding board 40 preriously described, may be arranged in this tapering casing beneath the opening 22 in the rear of the casing, and forming an inclosed chamber 57 between the sounding board and the bottom 2 of the casing. In this modified form of the invention, a sound conduit 58 is formed between the downwardly extending sounding board 56 in the bottom of the casing, the rearwardly converging side walls 4 , and the tapering top 7 , and within this conduit. the motor or actuating mechanism of the machine is suspended as lieretofore described. the conduit being in communication through a hollow bracket 20 with a sound reproducer arranged to cöperate with a record support mounted upon the corer of the casing, and rotated by the actuating mechanism within the sound conduit, as hereinbefore described.
A further modification of this invention tapering casing substantially identical with the tapering casing just described and shown in Figs. 4 and 5 but in which all internal sounding boards or deflecting boards other than the walls of the casing itself, are omitted from the interior of the casing. In this form of the invention, the bottom, top, rear and side walls of the casing form the four walls of an outwardly flaring sound conduit and sound amplifier 50 , in which the actuating mechanism of the machine is suspended as heretofore described, and through which the sound wares are transmitted and delivered from a sound reproducer as heretofore described when the machine is in operation.

A further modification of the form of casing which may be used in this invention is illustrater in Figs. 8 and 9, and comprises a substantially rectangular casing 1 similar to that previously described and shown in Figs. 1 to 3, and the machine in all its details haring this latter modified form of casing, is substantially identical
with the machine first described and shown in Figs. 1 to 3, except that sounding boards or deflecting boards other than the watls of the casing itself are not used in the in-
5 terior of the casing, and the walls of the casing form the walls of a sound conduit or amplifier 50 , in which the motor or acturating mechanism of the machine is smspended, and through which the somed waves are
10 transmitted and delivered from the machine as hereinbefore described, the walls of the casing acting to amplify and to deflect the sound waves being transmitted.

Although only a few of the forms in
is which this invention may be emboried have been illustrated, it is obvious that many changes might be made in the construction shown, but the right is reservel to make any or all changes in the construction which do
20 not depart from the spirit of this invention or the scope of the appended claims.

I have found that in the reproduction of sound from the invention hereinbefore described that there is a new and improved result, not only in increased volume. hat in the quality, purity and resonance of the somed reproduced, and while at the present time it may be that I may not be fully finformed as to the reasoms by which this imed restit in volume and quatity of tome is secured, and while all of the advantages resulting from this insention may not now be fully known or apprectated, if may be saich, and is thonght of be apparent from
35 the diselosines rontained herem. that this invention provides a simple, compand talkGug machine, of few parts, and of ine xpensive construction, that is very efliciont in operation, and that gives a lond, wear reprochuction of fine chality: and providen a talking machine in which space is erome mizer by localing the motor or acthating mechanism of the mardine in as somul comdhit thromgh which sombl waves are detis-
45 ered from the mathene. It is atson exident that this invention provides at balking mat chane in which the motere or ardating merell anism is inchosed in a casing which is also utilized in whole on in par as a somman and
50) plifier: :and provides at lallinge madhene in which the motor or :adnating merhmuinm is inclused in at andhit flamgh which the sombl wase are delisered from the sumbl

 fledors arranged to be exiaperoled with hy the sommel wases. It is nlan erident that this inncution providen al talking mumbun in which the motor or wetmongernerani - m

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 ing. nud in which the inturion of ther rame is divided by unc ow more sommeng homide
to form one or more inclosed spaces adjacent the space containing the motor. and in which the sate containing the motor is utilized as a channel for the transmiswion and delivery of sound wave from the machine: and provides other improwement- as disclosed herein.

In view of the fact that the adrantages of and the theory or theories conserming the speration of the talking machine forming the subject-matter of this invention maty not be fully known of apprectated at this time. the right is reserved to supplement thin disclosure by further statements in regard to the theories or advantages of the machine as such become betfer known.

Having thus dewribed my insemtion. I daim and desire to proted ly Lellem Patent of the T"nited states:

1. A talking machine comprising a tapering somed conduit and actuatinis mechlilnism for said machine located in sald comduit.
2. I taking machine conpriving a mond conduit, acthating mechanism for satid matchine locatere in said conduit, amd meman fors varying the intensity of somml 1 athemitted throngh sald combuit.
3. A talking machine comprininge : - - 1 mod comdnit, ardatinur medanhinu for ailal matrhine localed in said comelnit, aml at monathe clesime for varying the intensity of sumbl 1:allamitted thromg said mombut.
4. A talking machine comprinime 11 - mond
 outside of said comduit whd rommonicontine therewith, and admating mednani-m for and marchane lowated in satid rembluit.
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sound reproducing means in coöperative relation with said record support, a sound conduit communicating with said sound reproducing means and extending in said caschine located within said casino and in said conduit.
6. A talking machine comprising a casing, a lecord support carried by said casing, sound reproducing means outside of said casing in coöperative relation with said record support, a sound conduit communicating with said sound reproducing means and extending in said casing, and actuating mechanism for said machine located within said casing and in said conduit.
7. A talking machine comprising a casing, a record support carried by said casing, sound reproducing means in coöperative reboard in said rasing. and forming one wall of a sound conduit in communication with said sound reproducing means, and mechanism located in said sound conduit for actu5 ating said record support.
8. A talking machine comprising a casing, a record support carried by said casing, sound reproducing means in coöperative relation with said record support, a plurality of a plurality of walls of a sound conduit in communication with said sound reproducing means, and mechanism located in said conduit for actnating said record support.
9. A talking machine comprising a casing, a record support carried by said casing, sound reproducing means in coöperatice relation with said record support, a plurality of sounding boards arranged in said casing ing a plurality of walls of a sound conduit in communication with said sound reproducing means, and mechanism located in said conduit for actuating said record sup-
10. A talking machine comprising a casing, a record support carried by said casing, sound reproducing means in coöperative relation witle said record support, one of the wolls
50 of said casing forming a wall of a sonnd conduit, throngli which sounds are transmitted fron said sound reproducing means, and actuating mechanism for said machine located in said casing and within said conduit. said record support being outside of said conduit.
11. In a talking machine, the combination with a casing provided with an opening in one of the walls therenf, of sound repro-
60 ducing means locater outside of said casing and commmicating with the interior of said casing through said aperture a record support carried by said casing in coöperatire relation with said sound reproducing means,
65 one wall of said casing forming a part of a
sound conduit through which sounds are transmitted and delivered from said sound reproducing means, and actuating mechanism for said machine located within said casing and in said conduit.
12. In a talking machine, the combination with a casing provided with an aperture arranged abore the bottom of said casing, of a sounding board within said casing and beneath said aperture and forming the lower wall of a sound conduit, sound reproducing means communicating through said aperture with said conduit, and actuating mechanism for said machine located in said conduit.
13. In a talking machine, the combination with a casing provided with an aperture spaced from the bottom of said casing, of sound reproducing means communicating with the interior of said casing through said aperture, a sounding board in said casing and extending beneath said aperture, sounding boards arranged within said casing upon opposite sides of said aperture respectively, said sounding boards forming part of a sound conduit through which sounds are transmitted and delivered from said sound reproducing means, and actuating mechanism for said machine located in said conduit within said casing.
14. A talking machine comprising a sound conduit and amplifier, actuating mechanism for said machine located in said conduit and amplifier, and sound reproducing means located outside of said conduit and amplifier, and communicating therewith.
15. A talking machine comprising a casing provided with an opening in one wall thereof. a hollow bracket secured at one end to said wall, sound reproducing means contmunicating with the other end of said bracket, a record support carried by said casing in coöperative relation with said somed reproducing means, and actuating mechanism for said machinc located within said casing, said sound reproducing means beng in communication through said bracket and said opening with the space in said casing surronnding said actuating mechanism. Whereby said casing serves to inclose said motor and to form a sound conduit and sound amplifier for said sound reproducing means.
16. In a talking machine, the combination with a casing prorided with an opening in one wall thereof, of a hollow bracket secured at one end exteriorly to said wall and in communication with the interior of said casing throngh said opening, sound reproducing means communicating with the other end of said bracket, and actuating mechanism for said machine located in said rasing in the space communicating with said bracket.

21．In a talking machine，the combination with a sound amplifier，of sound reproduc－ ing means outside of said amplifier，and ac－ tuating mechanism for said machine located 3 in said amplifier．

22．In a talking machine，a casing having one of its walls forming part of a sommel amplifier，sound reprodncing means ontside of and commmicating with said amplifier， and actuating mechanism for sald machine located in said amplifier．

23．In a talking machine，a casing havingr one of its walls forming one wall of a sound amplificr，a somoding loard within sald con－
15 ing and forming another wall of said am－ plifier，actmating means for said machine lo－ cated in said amplifier，and sommd reproduc－ ing means carried by said rasing and com municating with said amplifier．

24 ．A talking machine comprising a cas－ ing having a substantially horizontal upper wall forming ati upper wall of atsomd con－ dhit，a somnding board within said casing between said w：all and the bottom of satid
25 casing forming a lower wall of said condnit． sounding boarifs within satid cossing form－ ing the side walls of simid condluit，and sommel reproducing means commmoraling with sitid condlıit．

25．A talking marhine romprising a cas－ ing having a substantially horizontal upper wall forming the＂pper wall of a somblat con－ dnit，an inclined sommding board in sated casing between satd wall and the botome ol
35 sald casing forming a lower wiall of satid conduit，diverging sommding boards in sald casing forming side walls for satil condnit． and somud reprodnciong means rommomic：at－ ing with said rondluit．

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60 tion will 1 casing poovided with all uperamir

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said bracket，and a record support carried by sald casing in coipperative relation with said somed reproducing means．

28．I talking machine comprising a cas－ ing．a sounding board inclosed by said cas－ ing forming a portion of a sombid condhit． sommd reproducing means coöperating with said condluit，and actmating merhaniom for satid machine located in satid conduit．

29．A talking mathine comprising it ras． ing．an inclined somoling board inclosed by said casing and forming a portion of a somid conduit．somed reprodiseing means coöper－ ating with said condluit，and actuating meedr－ anism for satid machine located in said ron－ 80 duit．

30．A talking machine（omprising in plla－ rality of diverging sounding boards ： 1 － ranged to form a phrality of exterior walls of a tapering somed condint，and adtuting 85 mechanism for siad machine loc：ated in satll condluit．

31．I talking mathine comproising is somal conduit，a rotary record support armated ontside of satid condnit and arthating merlt－ 90 anism for sald support arralled within sald condluit．

30．I talking machane comprisingr hollow sotmd amplifying moms．a remod support
 sonnd reprotheing meaths coijpriating with
 nism for salid marlame lor：ated within sall sommd amplifying me：ns．

3：3．I talking marhime romprising a sombl

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conduit including a hollow stationary portion and a movable tubular portion, sound reproducing means carried by said morable portion and coöperating with said conduit located in said stationary portion of said conduit.
38. The combination with sound reproducing means of hollow sound amplifying 10 means, a tubular sound conveyer, through which said sound reproducing means communicates with said sound amplifying means, a rotary record support and actuating mechanism for said support located in 15 said amplifying means.
39. A talking machine comprising a casing provicled with an opening forming a sound outlet, a sounding board inclosed by said casing, forming a portion of a sound
20 conduit, and arranged to deflect sound wares toward said outlet and actuating mechanism for said machine in said conduit.
40. A talking machine comprising a casing provided with an opening forming a
sound outlet, an inclined sounding board in- 25 closed by said casing, forming a portion of a sound conduit, and arranged to deflect sound waves toward said outlet, and actuating mechanism for said machine in said conduit.
41. Atalking machine comprising a sound 30 conduit, a rotary record support outside of said conduit, and actuating mechanism for said support coöperating therewith through a wall of said conduit.
42. A talking machine comprising a cas- 35 ing having a wall forming a portion of a sound conduit, a rotary record support and sound reproducing means coöperating therewith outside of said conduit, and actuating mechanism for said support extending within said conduit.

In witness whereof, I have hereunto set my hand this first day of September, A. D., 1909.

JOHN C. ENGLISH.
Witnesses:
Jay R. Grier,
Harry Cobb Kennedy.```


[^0]:    $\qquad$ -

[^1]:    65

[^2]:    si

[^3]:    80

[^4]:    70
    

[^5]:    105
    

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